No Dream Is Too High

Life Lessons From a Man Who Walked on the Moon

BUZZ ALDRIN

With Ken Abraham

Published by National Geographic Partners, LLC

The quoted comment from Ed White on this page is reprinted from Virgil "Gus" Grissom, *Gemini!: A Personal Account of Man's Venture Into Space* (New York: The Macmillan Company, 1968), p. 78.

The passage from the speech President Nixon prepared in case the Apollo 11 mission failed on this page is reprinted from William Safire, *Before the Fall: An Inside View of the Pre-Watergate White House* (New York: Doubleday, 2005). The actual speech is preserved in the National Archives in Washington, D.C.

Library of Congress Cataloging-in-Publication Data

Names: Aldrin, Buzz. | Abraham, Ken.
Title: No dream is too high : life lessons from a man who walked on the Moon / Buzz Aldrin with Ken Abraham.
Description: Washington, D.C. : National Geographic, 2016.
Identifiers: LCCN 2015037069 | ISBN 9781426216497 (hardback)
eISBN: 978-1-4262-1650-3
Subjects: LCSH: Aldrin, Buzz. | Aldrin, Buzz--Philosophy. | Conduct of life--Philosophy. | Astronauts--United States--Biography. | BISAC: BIOGRAPHY & AUTOBIOGRAPHY / Science & Technology. | REFERENCE / Personal &
Practical Guides. | SELF-HELP / Personal Growth / General.
Classification: LCC TL789.85.A4 A3 2016 | DDC 650.1--dc23
LC record available at http://lccn.loc.gov/2015037069

Since 1888, the National Geographic Society has funded more than 12,000 research, exploration, and preservation projects around the world. National

CONTENTS

COUNTDOWN

Buzz Aldrin is one of the most brilliant men I have ever met. Is he outspoken and opinionated? Oh, yes. Is he quirky? Oh, yeah. Is he eccentric at times? More than you can imagine!

But Buzz Aldrin is also one of the kindest men I have ever met. He has a heart that goes from here to the Moon and back. He is elegant and charming. He is a gentle man, generous to a fault, self-effacing, and intensely patriotic. He can be mildly irreverent, and he is one of the funniest people ever to walk on Earth or on the Moon.

Many people know Buzz from Apollo 11; others know him from his passionate speeches motivating the next generation of explorers to get their asses to Mars. Some people don't understand him when he speaks, but I know him well enough to be able to fill in the blanks.

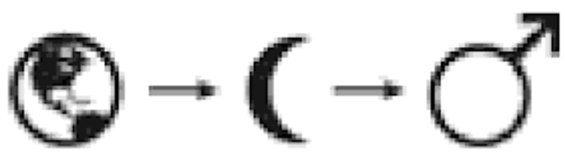
Some of the stories he is about to share, I've heard him tell many times; others are brand new, even to me. In the pages ahead, I'm excited for you to meet the Buzz Aldrin that I know. He has so much to share with us. He really does dream big … and for Buzz, dreams do come true!

Christina Korp

Manager and Mission Control Director to Dr. Buzz Aldrin

• CHAPTER ONE •

THE SKY IS *NOT* THE LIMIT … THERE ARE FOOTPRINTS ON THE MOON!



When I was a boy, some people regarded the statement "The sky is the limit" as a positive affirmation, implying that anything is possible. The truth is, the sky is *not* the limit. Nowadays, we can go much farther, and dream much higher than the sky.

I know the sky is not the limit, because there are footprints on the Moon—and I made some of them! So don't allow anyone to denigrate or inhibit your lofty aspirations. Your dreams can take you much higher and much farther than anyone ever thought possible! Mine certainly did.

For years, men and women dreamed of reaching space—exploring the Moon, other planets, and even the stars. But it wasn't until the 20th century that human beings experienced their first powered flight. In 1903, on a windy morning on Kill Devil Hills at Kitty Hawk, North Carolina, two young risktakers, Orville and Wilbur Wright, took to the air, defying gravity in their appropriately named plane, *Flyer*.

My mother, Marion Moon—yes, that was her real maiden name—was born that same year. A mere 66 years later, Neil

Armstrong and I set foot on the Moon, fulfilling the dreams of millions of people and far surpassing the expectations of those who claimed that the sky is the limit!

Nowadays, when I speak to young audiences, they are often surprised to learn that the United States was not the pioneer nation regarding space exploration. In October 1957, while I was still serving in the U.S. Air Force and stationed in Germany, the Soviet Union pulled off an unexpected technological feat. They launched Sputnik 1, a spherical, polished-metal artificial satellite with four transmitting radio antennas. The satellite emitted an odd *beep-beep* sound that could be heard on radio frequencies in the United States and elsewhere as the weird object orbited the Earth, passing several times directly over major cities in the United States. Although Sputnik's batteries ran out of power after only 21 days and the satellite eventually fell from orbit and was completely burned up as it reentered Earth's atmosphere, the Russians had led the way into space.

A year later, America formed the National Aeronautics and Space Administration—NASA—with the goal of reaching space. The space age was born, and a "space race" between Russia and the United States began, with each nation pouring millions of dollars and thousands of man-hours into besting each other's efforts. The term "space race" may have been a euphemism for the two nations' competitiveness, but the tension was real. Following World War II, the United States and the Soviet Union had emerged as the world's two great superpowers, both armed with nuclear weapons, facing off against each other in increasingly chilled relationships that came to be known as the cold war, with both nations suspicious of the other's motives.

That's why the world shuddered on April 12, 1961, when the Soviets achieved an incredible advantage by sending the first human into space, cosmonaut Yuri Gagarin, who flew in a spacecraft for one full orbit around the Earth.

The United States responded a few weeks later by launching America's first "Project Mercury" astronaut, Alan Shepard, on a 15-minute, 115-mile-high, suborbital flight

that touched the edge of space.

This was definitely impressive, and most Americans wondered, *What could possibly be next?*

(

President John F. Kennedy wanted an answer to that question as well, so he asked NASA and its ranks of engineers and rocket scientists, led by the brilliant Wernher von Braun, what was possible. They informed him that it would take *at least* 15 years before we could put a man on the Moon. It is a little known fact—one that I learned only recently—that Kennedy did not initially want the United States to go to the Moon. He wanted U.S. astronauts to go straight to Mars! NASA's leaders gulped hard and admitted to the president that Mars was out of reach, but the Moon might be possible within 15 years.

Rather than accepting what was "possible," on May 25, 1961, just three weeks after Alan Shepard's virginal flight, President Kennedy boldly challenged America to commit to the goal of landing a man on the Moon before the end of the decade! Many thought the challenge was impossible to meet. We had not yet even put a man into orbit. The rockets and spacecraft that we needed to go *beyond* Earth's orbit didn't exist. We didn't have the know-how.

But we *did* have a leader with a vision—including the determination, courage, and confidence that we could get there. Even when the NASA chief later informed the president that it was going to cost twice the amount of their initial projections, the president stuck with his commitment. By publicly stating our goal and by putting a time period on a specific accomplishment, President Kennedy gave us no way out. We either *had* to do it or fail, and no one was interested in failing, especially with the Russians already peering over our shoulders from their spacecraft.

When I first heard about America's space program from my friend and fellow fighter pilot Ed White, who had signed on with NASA, I was excited. If space was going to be our next

new frontier, I wanted to be a part of getting there. So after I completed my tour of duty in Germany, I continued my education and received my doctorate in astronautics from the Massachusetts Institute of Technology (MIT). For my thesis, I adapted my experience as a fighter pilot during the Korean War, where I had focused on intercepting enemy aircraft, and devised a technique for two manned spacecraft to meet in space, a procedure called manned orbital rendezvous. Little did anyone—including me—know how critical this work would later be to our successfully landing on the Moon.

The first time I applied to be an astronaut, NASA turned me down. I was not a test pilot, they said, and at that time, NASA wanted *only* test pilots. Other people, no matter how bright or how talented, need not apply. Sure, I was disappointed, but I was determined and I knew the sky was not the limit, so I applied again.

This time, my jet fighter experience and NASA's interest in my concepts for space rendezvous influenced them to accept me in the third group of astronauts, eight men drawn from more than 6,000 applicants.

My MIT rendezvous studies really paid off. I knew that the critical key to our success would be our ability to separate the lunar landing module from a launch-and-reentry "mother ship," a command module, land it on the Moon's surface, then lift off and reliably rendezvous the two spacecraft in orbit around the Moon, a risky maneuver. If it failed, there would be no way to rescue the astronauts who had landed. Luckily, my MIT work was exactly what was needed to help figure out these complicated rejoining procedures. I thought about space rendezvous; talked about space rendezvous; ate, slept, and *dreamed* about space rendezvous so much that I became known to my astronaut peers as "Dr. Rendezvous."

Mercury was the first phase in the American space efforts, followed by the Gemini program, which helped us refine our skills and maintained the nation's fascination with space travel while the rockets were being developed for Apollo, the program that we hoped would take us to the Moon. Gemini was an integral part of our training, as it helped us learn to

spacewalk. As an avid scuba diver, I was the first astronaut to train underwater to simulate weightlessness in space. Although not identical to the sensations in space, practicing movements underwater in neutral buoyancy and attempting to maneuver while wearing a bulky backpack gave me great confidence and helped me to overcome the challenges I thought I might experience once outside the space capsule.

During my first spaceflight as pilot of Gemini 12, I set a world record for spacewalking—which was actually more of a space *float*, rather than a five and a half hours' "walk" in space—tethered to the spacecraft by a single, long umbilical cord that provided life support, while circling the globe every 90 minutes at a speed of 17,500 miles an hour. Because there is no air in space, there was no resistance, so the spacecraft and I drifted along at the same tremendous speed. What a sight to behold the Earth below while floating *outside* our spacecraft! It was such a fabulous ride, I only reluctantly climbed back inside our Gemini 12 spacecraft when it was time to come home, but not before I pulled a prank on Jim Lovell.

Most people know that astronauts are competitive with each other, even those working together as crewmates, as were Jim Lovell and I on Gemini 12. Knowing that I was scheduled to perform a space walk during our flight, I had packed a banner reading "BEAT NAVY" among my personal items. I was a West Point grad, and an Air Force fighter pilot, and Jim was a Navy guy. So while I was outside doing my space walk, I took the banner with me and unfurled it, holding it up to the Gemini 12 window so Jim would have to read "Beat Navy." I still have that banner to this day, not to mention a hefty dose of competition with the Navy and with Jim!

During the same space walk, I took what would become known as the first "selfie" in space! But I'll tell you more about that later.

After nearly four days in orbit, Jim Lovell and I returned to Earth, having completed the final mission in the Gemini program. It was November 1966, and we had only three

years remaining to accomplish President Kennedy's challenge to land a man on the Moon by the end of the decade. Gemini had prepared us for the Apollo missions to the Moon, but we still had a lot of work to do.

Neil Armstrong, Michael Collins, and I were chosen as the crew for Apollo 11, which would turn out to be a uniquely historic mission. Neil and I had worked together as the backup crew for Apollo 8, the first mission to reach the Moon, although not landing on the surface. Mike was originally part of the Apollo 8 crew, but due to back surgery, he had to be replaced, and he missed the opportunity. A great guy, a hard worker, and a real team player with a quick sense of humor, Mike had studied and trained diligently for Apollo 8, so I was not surprised when Neil chose Mike for our crew. He was an excellent choice.

For six months, we worked every day and prepared as best we could for this fascinating trip into the unknown. At last, the day came when the enormous Saturn V rocket was rolled out from the huge Vehicle Assembly Building, inching along on a giant transport platform, slowly making its way to the launchpad.

On July 16, 1969, our launch day, at 9:32 a.m. the engines ignited and roared with more than 7 million pounds of thrust, lifting 3,000 tons of spacecraft, fuel, equipment, and, oh yes—three very fortunate human astronauts on their way to another celestial body.

As we cleared the gantry and rocketed skyward, we were pressed into our seats as the rapid acceleration of the rocket increased our body weight. Within three minutes, we were 45 miles high, experiencing 3½ g's—the force making our bodies feel increasingly heavier than on Earth—and accelerating to nearly 6,500 miles an hour. A minute later, we passed through the 62-mile threshold, where the blue sky turns to the blackness of space. By 12 minutes after launch, we were traveling at more than 17,000 miles an hour, the speed required for us to orbit the Earth. For the next three hours, we circled around our home planet and ran through checklists to make sure that everything in our spacecraft was

working properly. Then we fired the rocket engine that accelerated us to 25,000 miles an hour on a trajectory bound for the Moon.

During the eight-day round-trip journey, Mike, Neil, and I lived in a space capsule about the size of a standard automobile interior—a small vehicle not much larger than a Volkswagen van. If all went as planned, Neil and I would spend a portion of that time landing on and exploring a small part of the lunar surface.

☾

ON DAY THREE, WE FIRED OUR ENGINE to slow us down enough for the Moon's gravity to capture us and draw us into lunar orbit. Another engine burn put us in the right orbit for a landing.

Thirteen orbits of the Moon later, on the morning of Sunday, July 20, 1969, Neil and I entered the lunar landing craft we had named the *Eagle*. We carefully separated our new home from the command module, *Columbia*, where Mike remained. Piloting our powered descent to the Moon's Sea of Tranquility was the most complicated and critical aspect of the whole mission. Landing was the hard part.

As we descended, we saw that our planned landing site was filled with large boulders surrounding a crater that Neil estimated to be more than a hundred feet wide, with steep slopes, so we continued maneuvering the *Eagle*, hoping to find a safe area on which to land. This unexpected extension of our trip expended additional fuel, so after traveling 240,000 miles to reach the Moon's surface, we were dangerously low on fuel and within seconds of having to either abort the mission or crash onto the lunar surface. Hovering above the Moon's surface like a slow-moving helicopter, Neil finally spied what appeared to be a safe landing spot. When we finally touched down, we had only 15 to 20 seconds of fuel remaining!

Neil and I breathed a little easier but we couldn't relax. We

shook hands—we had done it; we had landed on the Moon! But this was no time for a victory party; we quickly went through our flight checklist. It was absolutely essential that we not allow our emotions to overwhelm us or cloud our thinking as we followed our planned procedures in case we had to make a hasty departure from the Moon, using an entirely different rocket engine from the one we'd used for our descent. Finally, I paused long enough to glance out the window at the black velvet sky and the ash gray, pockmarked terrain on which we had landed. With our engines shut down, we were surrounded by a celestial silence; the only sound I could hear was my own breathing.

Giving voice to a surprise that only he; Mike; our fellow astronaut Charlie Duke, who was serving as our spacecraft or capsule communicator (CAPCOM); and I knew about, Neil spoke the words "Houston, Tranquility Base here. The *Eagle* has landed." Nobody else on Earth knew that we were going to call our little portion of the Moon "Tranquility Base," and even Charlie seemed slightly caught off guard.

"Roger, Twan …" he started to mispronounce the name, and then corrected himself. "Tranquility."

Although few people were familiar with Tranquility Base, everyone in the world understood the significance of the latter part of Neil's calm declaration. "The *Eagle* has landed." Human beings were on the Moon!

☾

One of my assignments while on the surface was to literally kick up some Moon dust and observe the dust's "scuff/cohesion/adhesion" qualities. Because there is no air on the Moon, and only one-sixth of the gravity we are accustomed to on Earth, each kick of my boot sent Moon dust spraying out from my boot and falling back to the surface in perfect little semicircles, appearing almost like a handheld fan.

I was intrigued by the Moon dust, so while Neil was

collecting rock samples, I borrowed the camera. I looked around the lunar surface for an undisturbed area where we had not walked so I could take a shot of a footprint. I found a good location and took a picture of the gray surface. Then I carefully pressed my foot down right in the center of the flat area I had photographed—sort of a "before" and an "after" shot. Barring obliteration by an asteroid or future human disturbance, I realized that the single, solitary footprint showing impressions made by the treads of my boot would remain intact on the lunar surface for thousands of years, convincing future explorers that man had indeed walked on the Moon.

But the more I looked at the footprint, it struck me, *Hmm, that isolated print is rather lonely looking.* So I had another idea. *I'm going to put my foot down on the surface and then pull my boot up and away from the footprint, but only slightly, still keeping my boot in the frame.*

The resulting photograph of my foot and footprint on the Moon became another famous piece of history, a symbol of human beings' passion to explore, and a powerful reminder that the sky is not the limit, because there are footprints on the Moon. Those bootprint photos are among the few that I took while on the Moon.

When Neil and I got back in the *Eagle*, we took off our heavy backpacks, and along with other unnecessary items such as our boots and our specially designed, 70-millimeter Hasselblad camera, we placed them in garbage bags and tossed them out on the lunar surface. Those items are still on the Moon today. In retrospect, we probably should have tossed out our helmets rather than the boots—that might have had more historic significance—and the Hasselblad camera; the helmets were much heavier, but there was always the possibility that we might still need them. Perhaps future space environmentalists will find our castoffs and criticize us for so inconsiderately discarding our "trash," but we dared not take off with one ounce more than planned, and we had already picked up some weight with the more than 45 pounds of rocks we had gathered on the Moon to

take back to Earth for study.

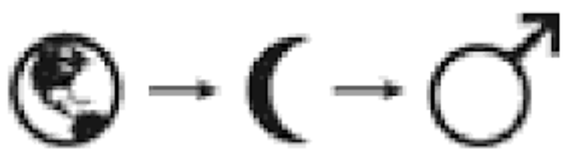
We left a commemorative plaque on the lunar surface. Dated July 1969, the plaque depicts the two hemispheres of the Earth and reads: "HERE MEN FROM THE PLANET EARTH FIRST SET FOOT UPON THE MOON. WE CAME IN PEACE FOR ALL MANKIND."

I'VE LEARNED MUCH ABOUT MYSELF since the *Eagle* whisked Neil and me off the lunar surface all those years ago. I've experienced my share of ups and downs, some successes and failures; I've met a lot of interesting people, and I've had a lot of fun. Some of the lessons I've learned have been painful; others have been hilarious. All have helped shape me and have served me well. I know the lessons I will share with you in this book *work*, because I have tested them for more than 86 years. They have worked for me, and I believe that if you will adapt them to your circumstances, they will serve you well, too.

One truth I have discovered for sure: When you believe that all things are possible and you are willing to work hard to accomplish your goals, you *can* achieve the next "impossible" dream. No dream is too high!

• CHAPTER TWO •

KEEP YOUR MIND OPEN TO POSSIBILITIES.



I've often said, "Your mind is like a parachute: If it isn't open, it doesn't work."

Innovators and explorers like to ponder what might be possible, not merely what is expected. That's why I try to stay open to new ideas. I'm constantly dreaming up new things, sketching new rocket designs, and looking for new areas to explore.

"Innovation" is my middle name … unless I decide to change it to "Lightyear." In fact, one of the awards of which I am most proud is the Lifetime Innovation Achievement Award I received in 2015 from New Jersey, the state where I lived as a boy.

Speaking of my name, people often ask me, "Colonel Aldrin, is Buzz your real name?"

The answer is yes. Although my parents named me Edwin Eugene Aldrin, Jr., when I was born, Fay Ann, my two-year-old sister, had difficulty pronouncing "brother," so she called me "Buzzer." No doubt, over the years, a few people have called me "Buzzard," but from the time I was a baby, the

name Buzz has been a part of my life. Years later, after Apollo 11, and after my father, for whom I had been named, passed away, I legally changed my name simply for the convenience and clarity. But although Buzz is now my real legal name, innovation is my guiding spirit. I've always been quick to try new ideas, especially new ways of doing things in space.

During the early years of space exploration, a number of the initial Russian cosmonauts and American astronauts had experienced nausea during their first trips into space. Their bodies simply weren't accustomed to the unusual sensations and disorientation brought on by trying to move and work in a weightless environment. In preparation for my Gemini 12 space walk, I welcomed the opportunity to become the first astronaut trained underwater in a swimming pool to simulate the effects of neutral buoyancy, trying to maneuver in a weightless environment in space. Some of my colleagues thought I was being eccentric, but the sensations in the pool prepared me for what it might feel like drifting along at 17,500 miles an hour, tethered to a spacecraft.

Ironically, in space exploration, as in business or any other area of life, past success can be the greatest obstacle to future innovation. Even wonderfully brilliant people can become entrenched in the status quo, stuck in the usual way of doing things. One of the greatest impediments to discovery is the attitude that says, "We don't do things that way," or its counterpart, "We've never done things that way." Which basically means, "I don't want to change."

So we've never done it that way before? Great! Let's try something new; let's come up with a different approach, another way of reaching our goals. You have to stay open to the possibilities. Remember, your mind is like a parachute: If it isn't open, it doesn't work. So keep an open mind!

It was a man with an open mind who made it physically possible for human beings to land on the Moon. Many people have never heard of him, but John Houbolt was the man who may have saved the space program.

During the early days of television and motion pictures, it

was not uncommon to see a science fiction movie depicting an enormous spacecraft blasting off from Earth and landing on the Moon. That single spacecraft idea had become so embedded in people's minds, rarely did anyone question how in the world we were going to send a massive rocket like that to the Moon, land on the surface, explore, then blast off again and return to Earth, where we'd need another safe landing. Even scientists were baffled, scratching their heads in frustration because everyone thought in terms of only one gigantic spacecraft.

Everyone, that is, except John Houbolt, a bright, clever NASA engineer. John came up with the concept of using two specialized spacecraft—a command/service module and a lunar landing module—rather than one heavy spaceship in our efforts to get to the Moon, land on the surface, and get back home. The command module would stay in orbit around the Moon while the lunar landing module would be equipped with a "descent" stage that could be left on the surface, as well as an "ascent" stage with its own engine for blasting off the Moon and then rendezvousing with the command module. This was especially important because the lunar lander's rocket motors did not have to be nearly so large, since they would be needed only to power the ascent section until it rendezvoused with the command module for the return trip back to Earth.

It was a novel idea, and many people at NASA questioned John's "fanciful notions," but they finally realized the advantages of having two spacecraft rather than one huge one. John's willingness to keep his mind open and to think creatively opened the door to whole new vistas of space exploration.

Another brilliant, open-minded engineer who worked with us on the Apollo program was Hubert (Hu) Davis. Although the astronauts training for a potential landing on the Moon might not have realized it early on, the lunar landing modules (LMs) were too heavy to safely land. Hubert Davis was the project manager for LM-5, and when he heard about the problem and that his spacecraft was not slated to land, he

said to NASA, "We'll work to reduce the weight, if you will consider putting LM-5 as the first lander." Hu and his team went back to work. They tried everything they knew to do.

After five versions of the LM (LM-1 to LM-5), it was still too heavy. Hubert didn't say, "Well, that's too bad; that's what the lander has to be, so deal with it." No, just the opposite. Hubert Davis put his mind to work on every way possible to reduce the weight load of the lunar lander, considering everything from the metallic materials used on the outside "skin" of the lander to how many pens Neil and I carried aboard the spacecraft. Every ounce mattered.

When almost everyone said it was impossible, Hubert Davis found a way to lighten the weight of the LM, making it possible for LM-5 to land on the Moon. Because of Hu's imaginative thinking, NASA began offering financial bonuses to aerospace companies and contractors who could reduce the weight of the LMs in production. Had Hu not found a way, Neil and I would not have attempted a landing during Apollo 11, and NASA would have been forced to wait for LM-6 and Apollo 12—or possibly even later—to land. So in a very real way, Hubert Davis made it possible for Neil and me to land on the Moon. Why? Because Hubert Davis kept his mind open to the possibilities.

☾

INNOVATORS ARE OFTEN OUT OF SYNC with many people around them. No doubt about it—from Leonardo da Vinci to my friend Sir Richard Branson, owner of Virgin Galactic—some of history's most creative people have been a bit quirky. Anyone who saw Albert Einstein trudging along the sidewalks of Princeton University with a briar pipe hanging out of his mouth might have assumed the odd fellow in the old, frumpy overcoat and socks that didn't match was a hobo. Today, students at Princeton are still studying Einstein's formulas and ideas, and his adage "Subtle is the Lord, but malicious He is not" is inscribed in the stone mantel of the

fireplace in the mathematics building on campus. I guess I used many of Einstein's ideas when I developed my own mathematical equations regarding space rendezvous.

Because of my fascination with rendezvous principles necessary for the lunar module to lift off the Moon's surface and be reunited with the command module, some of my fellow astronauts thought I was obsessed with the subject. They called me "Dr. Rendezvous," usually with respect, but sometimes with a hint of derision as well. I didn't care; I knew I was a little out of sync with my buddies, but that was okay. I was doing what I loved.

Sometimes innovators come across as arrogant, stubborn, or unreasonable. I'm sorry to say that I probably did, too, while working as an astronaut. Think of people such as Elon Musk, the driving force behind SpaceX, the company upon whom America is currently relying to deliver supplies and equipment to the International Space Station. Or think of Jeff Bezos, who founded Amazon.com, or Steve Jobs, the whiz behind Apple's success. As young men, they were out of sync with many of their peers; they saw things differently, wanted to do things differently. They refused to simply accept the "usual" way. Rather than seeing the world with a "that's just the way things are" attitude, they developed an intense, indefatigable desire to improve the world by radically changing the way things could be done. We relish their successes today, acknowledging that these innovators and others like them have changed our world to fit their vision of how life can be better.

Average people tend to think about merely maintaining the status quo; unsuccessful people think about simply surviving. Innovators and explorers think about what might be possible.

☾

PARENTS AND EDUCATORS OFTEN ASK me, "Buzz, how can we help foster the sort of innovation that took you to the Moon?"

First and foremost, it is important to understand that

whether by nature or nurture, innovators approach the world differently. Keeping that in mind might help you to regard your boss with greater respect, or your artist friend, or the kid who wants to sit around playing his guitar all day long. Certainly, some people are born with innovation in their veins. I think I was. My father loved flying and exposed me to the possibilities of flight early in my life, but something inside me responded far beyond what my father might have imagined.

I also think that innovation can be encouraged when parents and educators understand that innovators often do not fit "the norm." Innovators whose minds are open tend to have personality traits that others might regard as quirky or sometimes even "weird." They are dreamers, and I am definitely one of them, so I know that innovators are rarely content merely to dream. They won't stop there—especially if they receive some encouragement. They will become *doers;* they will make things happen. Innovators are usually much more self-confident than their peers; they are inner directed and willing to march to the beat of their own drums. But it sure helps having someone lay a hand on a shoulder or look the innovator in the eye and say, "I believe in you; you can do it."

Often innovators are courageous and resilient, sometimes because they have had to develop such qualities in the face of adversity or opposition to their ideas. Almost always, they are risktakers, willing to try something new.

So understanding that the innovator's personality causes him or her to be out of sync with others is tremendously important, especially when it comes to encouraging exploration of new concepts or new ways of doing things.

Second, it is important to understand that innovation usually takes time. Great ideas rarely move from the mind to the Moon, or to the marketplace, overnight. They need time to percolate, to improve, to develop. At NASA, we were constantly working to make improvements on our spacecraft, as well as ourselves, as we pursued our goals. Innovators need a place to do that, and in most cases, nowadays, great

innovation necessitates somebody providing a physical place and the financial resources that allow creativity to thrive. Personally, I love living at the beach; the environment itself helps stimulate my thinking. For me, dull, drab, gray walls are not normally conducive to my creativity. But whatever your preferences, recognize that your physical space will be an important component in stifling or fostering your creative juices. Even if you live in a small, one-room apartment, create a space around you where creativity can thrive.

Innovators must be encouraged to experiment with new ideas, new ways of doing things. Rather than being punished for mistakes or failures, they should be applauded for attempting to go where human beings have never gone before. That means innovators must be given the freedom to challenge the status quo. Certainly, this requires a great deal of patience and trust on the part of parents, educators, and CEOs, but as you look around our society, businesses as well as scientific cultures that encourage innovation are thriving. Companies such as Google and Apple have created a culture that empowers their employees to stretch, to attempt the "impossible dream," to explore, to go after opportunities that may not always work out.

Third, to encourage innovation, we must model and communicate that "thinking" is not wasted time but is integral to the innovation process. Unfortunately, most educators and almost all employers expect thinking to be done on a person's own time, not on the clock. Imagine you are sitting at your desk, ruminating about an idea, when your boss comes along. What's the first thing most of us do? We try to "look busy."

Allowing a person time and freedom to peer off into space, to daydream if you will, about an idea's potential is not permitting that person to be idle or unproductive. It is allowing him or her to think creatively. Allowing for the thinking process to develop in a person's mind is essential if we ever expect that individual to provide us with those *voilà!* moments. People who achieve the great breakthroughs in our world have usually already experienced those breakthroughs

in their mental processing; they've seen the idea working in their mind long before they ever tried it in "real life." Before I ever took my first walk in space, I saw it in my mind many times, imagining what it might look like, feel like, sound like —all in my mind. If we want to foster innovation, we must encourage an atmosphere that allows for creative thinking, even if, to some people who may not understand, it looks as though nothing tangible is being done or accomplished.

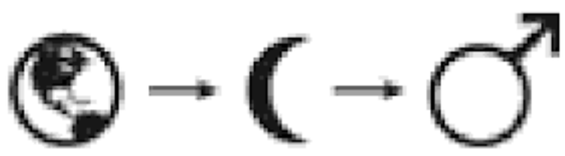
Innovators view change as an opportunity rather than an inconvenience or an interruption. At 86 years of age, I decided to move from Los Angeles back to near Cape Canaveral in Florida. Sure, it is challenging to deal with change, but I always want to be open to new opportunities. Most people don't like to move out of their comfort zones, but as we all know, change is inevitable. You can resist it and complain about it as an inconvenience, or you can regard change as your chance to do something new. Keep that parachute open. Use your mind to ponder the possibilities rather than to pooh-pooh the interruptions change brings to your "normal" way of doing things.

Albert von Szent-Györgyi, the Hungarian Nobel Prize–winning physiologist who first discovered the benefits of vitamin C, was fond of saying, "Discovery lies in seeing what everyone sees, but thinking what no one else has thought."

That was a man who kept his mind open to the possibilities, and that's the kind of man I have tried to be, and always want to be.

• CHAPTER THREE •

SHOW ME YOUR FRIENDS, AND I WILL SHOW YOU YOUR FUTURE.



Choose your heroes wisely, and be careful who you idolize. Why? Simple: You will become like the people with whom you most often associate. The people with whom you surround yourself will have an impact on you, either positively or negatively. It is a timeless truth that bad company corrupts good character, but if you walk with the wise, you will become more like them.

I've been blessed with some great friends, people who have not only given of themselves to help me, but who have helped to bring out the best in me. Other than my father, one person who was a great friend to me, as well as my most influential mentor, was Jimmy Doolittle, the famous aviator. When my dad introduced me to Doolittle, I was just a kid, but the world-renowned pilot took time with me and encouraged me to pursue my own dreams of flying.

When my father passed away, Jimmy Doolittle, more than any other person, encouraged me and helped me to deal with my dad's death, and to keep moving forward with my own life.

Another of the places where I experienced that sort of friendship and camaraderie was in the Air Force.

A year before I graduated from West Point, I went along with my fellow cadets on a social science tour of the Far East, studying General Douglas MacArthur's occupation of Japan. When I awakened after my first night in Tokyo, the newspaper headlines read: "NORTH KOREA ATTACKS SOUTH KOREA."

To the world's surprise, 75,000 North Korean soldiers had poured across the 38th parallel, the boundary between the Soviet-backed Democratic People's Republic of Korea to the north and the pro-Western Republic of Korea to the south. As an ally of the United States, South Korea sought our help, and the United States was determined to come to the aid of our friend. As far as Americans were concerned, North Korea's unprovoked attack against South Korea was an example of communist aggression, and many people felt certain that the communists would not stop at Korea, that this was a blatant step toward communist world domination.

Consequently, by July 1950, American troops entered the war on South Korea's behalf. Although I still had another year to go at West Point, I knew that if the war continued, I would soon be fighting in Korea.

My father had urged me to attend the Naval Academy —"You can still fly in the Navy," he said, but my friends and I wanted to be where the action was—and that was in the skies above Korea. Of course, my natural interest in aviation nudged me more toward enlisting in what had until recently been known as the Army Air Corps and eventually became a separate branch of the military, the U.S. Air Force.

By the end of the summer, U.S.-led allies pushed the North Koreans out of Seoul and back to their side of the 38th parallel. But as American troops crossed the boundary and headed north toward the Yalu River, the border between North Korea and communist China, the Chinese started squawking about what they called "armed aggression against Chinese territory." Chinese leader Mao Zedong even sent troops to North Korea and warned the United States to keep

away from the Yalu boundary unless we wanted to engage *them* in a full-scale war. With China threatening to get involved and images of World War II still fresh in our minds, many people worried that we were getting dangerously close to World War III.

I graduated number three in my class at West Point, and by December 1952, even though negotiators were trying to bring the war to a close, I put in for combat duty stationed in Korea. I had already earned my wings and qualified as a pilot of the Sabre F-86; I soloed in prop T-6's at Bartow Air Force Base in Florida and then flew jets at Bryan Air Force Base in Texas, so I sure didn't want a desk job!

Flying the Sabre F-86 swept-wing fighter jet and chasing the enemy's superagile, Soviet-made MiG-15 jets were some of the most exciting moments of my life. I flew 66 missions over the war zone, had a few close calls, and I shot down two enemy MiGs.

The MiGs could fly higher and faster than our fighter jets, and they carried a vicious 37-millimeter cannon and two 23-millimeter automatics that could shred an F-86 with one burst of fire. But what the American-made planes lacked in altitude and speed, we more than compensated for with advanced technology, much as we would in the space race in the 1960s and 1970s.

On May 14, 1953, I was flying on patrol, hunting for enemy aircraft in the skies just south of the Yalu River. Because the North Korean ground war effort had almost disintegrated, they had moved many of their best planes as far north as possible, close to the Yalu in a location my buddies and I referred to as "MiG Alley." On a good day, it could be like picking off ducks in a shooting gallery, with "free" shots at enemy planes still on the ground. On a bad day, an F-86 pilot could experience his worst nightmare—a faster killing machine with deadly firepower on his tail, or worse yet, two or three MiGs surrounding him in a dogfight that was certain not to last very long.

On that day in May, I was the pilot with the advantage. Flying just south of the Yalu, I spied a MiG cruising ahead of

me, straight and level. Apparently, he didn't know that I was nearby or he would not have been so lackadaisical. I aimed my guns at him and fired, lighting up the MiG.

The enemy fighter jet spun hard and pitched toward the ground. The pilot, still alive, succeeded in ejecting from his cockpit, but his plane streaked toward the Earth. The camera on the gun of my F-86 recorded the whole episode, including the pilot's ejection and the plane veering toward destruction. Actually, I'm glad the pilot ejected, and I like to think that he escaped harm, even though I shot down his plane. I've always thought of myself as a "gentle" fighter pilot!

Our military public relations guys, however, loved those videos of "kills," and several photo frames from the incident appeared in the next issue of *Life* magazine, one of the premier news magazines of that time.

About a month later, I was flying a mission with three other pilots attached to the 16th "Blue Tail" Squadron, and following four other, newer Sabre jets from the 39th "Yellow Tail" Squadron. Just as we were taking off, my wingman aborted his flight, so I radioed my commander for permission to join up with the Yellow Tails. That was okay at first, but the newer F-86 Sabres were much faster than my older F-86 model, and I was having a tough time staying with them. When they dove toward a valley near the Yalu, blasting away at an enemy airfield, I couldn't keep up with them, even with my airspeed indicator pegged.

I spotted some enemy MiGs racing down the runway, hoping to get into the air, both to save their planes and to engage the Sabres. Just then, an enemy fighter jet streaked across my sight from left to right. Because I had been unable to keep up with my buddies, I was behind them, and if I could stay calm, I had a shot at the MiG. If I missed him, he'd be right on the tail of my buddies.

I tried to slow my aircraft before he saw me, but the MiG pilot spotted me and banked hard in my direction. The good news was that I had pulled him off my friends. The bad news? He was coming after *me!* Worse yet, I realized that as fast as I was flying, I was bound to sweep right into his line

of fire. My only hope was a desperate, dangerous maneuver that pilots referred to as a "scissors" move, cutting across the enemy's path, with both aircraft crisscrossing back and forth, each trying to seize an advantage. We ripped through one set of scissors moves and then I banked so steeply that my wingtips pointed straight down to the ground as I raced above the enemy runway, flying sideways. I could hear enemy antiaircraft fire all around me, but I hadn't been hit. The MiG rolled off to avoid a mountainous ridge below us, and I knew this was my chance—probably my only shot.

I tried to fire, but the aiming dot on my gun sight jammed! Still flying with my left wing pointing toward the earth, I used my plane's nose as a sight and pressed hard on the trigger of my .50-caliber machine gun.

I saw something spark on the MiG, so I quickly rolled back parallel to the ground, pulled hard on the throttle, and gassed it for all the F-86 was worth. The MiG was still in front of me, and he was going into a steep right-hand turn to come back after me. I fired again and saw tracers sparking across his wing, but he was still going! We were too close to the ground for this fight to last much longer; I knew one of us was going down. The enemy rolled out of the turn and dove, so I fired two more rapid bursts from the machine guns, just as he turned up toward me.

It was like a slow-motion movie as I watched the enemy plane's nose come up and seem to hang in the air, the engine stalling. The canopy of the jet opened, and I saw the flash of the pilot's ejection flare. Whether he had time to open a parachute, I don't know, but the MiG definitely beat him to the ground.

There was no time to celebrate. I had been going so fast that I had little idea where I was, but I figured I was about 20 miles north of the Yalu, and there were more Russian and now Chinese planes as well, rising off the runway below. I turned south and hightailed it out of there as fast as I could, fortunately picking up the Manchurian Express, a jet stream that helped me fly even faster with less resistance, which was another stroke of luck, because I was running low on fuel. I

had no idea where my buddies were, and as I was climbing out, I suddenly realized that I still had my speed brakes engaged. I felt like an idiot, but fortunately I was able to correct the mistake and make it back to our base.

The Air Force awarded me an Oak Leaf Cluster as well as the Distinguished Flying Cross for dropping the first MiG, and although my gun camera clearly showed that I had destroyed the second enemy plane, there was a question as to which side of the Yalu River I had been on when I shot it down. Consequently, I received no special honor for winning one of the most dangerous battles of my life. But I was thrilled that I had helped to protect my buddies and that I had taken another enemy of our nation out of the sky. As with many conflicts I'd encounter in life, it really didn't matter who got the credit. What mattered was taking care of each other.

I'm certainly not infallible, and I've had some experiences that some of my friends and colleagues might be ashamed to admit. But we all make mistakes and sometimes cross some lines that we shouldn't. A few of my mistakes almost cost me my life.

On another occasion, I almost ran out of fuel while flying close to the Chinese/North Korean border. I had to stay calm and nurse my fuel supply all the way back to base. As I've often said, fighter pilots don't have emotions; we have ice in our veins. That quality served me well when, 16 years later, the Apollo 11 computers began to malfunction, just as Neil and I closed in on landing on the Moon. I'll tell you more about that later!

On one patrol over northern Korea, I was flying in formation with good friend and wingman Sam Johnson when we lost contact. The wingmen looked out for each other, flying side by side and watching each other's backs. Sam and I flew all the way to the Yalu River, the boundary American pilots were warned not to cross.

We saw some movement on the ground and some other things going on that we might be able to do something about, but we had no orders from our commanding officers allowing us to attack, and we were too close to the Yalu River and the Chinese border, plus I was concerned about our fuel levels. It was a dangerous situation.

I said to Sam, "It's time to head back." I looked out my cockpit window, expecting to see Sam behind me to the side, but I couldn't spot him and he didn't respond. That wasn't like Sam, so I got worried.

"Sam, where are you?" I asked. "I can't see you."

Suddenly, through the familiar sound of Sam's gunnery fire, *rat-a-tat-tat; ehh-ehh-ehh-ehh*, I heard Sam's voice on my headset. "I'll be right with you, Buzz!" More gunnery fire: *Ehh-ehhh-ehhh-ehhhh.* Clearly, Sam was engaged with the enemy somewhere in the skies nearby. I swerved my F-86 hard, turning around quickly, as my eyes searched for Sam's plane. If my buddy was in trouble, I had to help him.

Next thing I knew, Sam was flying right beside me. We chased the MiGs as far as we dared, but they were too fast for us to catch up. We zoomed out of the danger zone and headed back to South Korea, watching our fuel gauges all the way.

When we finally got back to our base and landed, we got chewed out royally by our commanding officers. I didn't mind the scolding. After all, there was no way I was going to leave my friend when he needed me most.

To me, that is one of the most important principles of life: Never leave your friends behind. Consequently, throughout my lifetime, I've tried to keep in touch with my buddies, even though it has not always been easy, because most of us have stayed quite busy. In times past, I'd burn up the telephone lines; these days, text messaging has become my preferred method of communication, a great way for me to stay connected with my friends. But don't kid yourself. Keeping in touch requires intentionality. You must consciously make the effort to stay connected with your friends, or it won't happen. You'll gradually slip away from

each other, like a married couple that once loved each other but allowed the sparks of passion and the flame of love to be snuffed out.

Time goes by and we all get caught up with daily responsibilities, priorities, and the tyranny of the urgent. It is easy to get so busy that we forget about those people who have played such important roles in our lives, so every so often, I will swing back to see how my friends are doing. It doesn't take a lot to do that. Maybe a quick phone call or a text message, perhaps a letter or a card in the mail. But it is important to stay connected, because life gives none of us any guarantees. I'm proud to say that the West Point class of 1951 keeps in contact regularly. For instance, my friend and West Point classmate Jack Craigie and I have known each other since we were 18 years old. Today, with both of us past 86 years of age, we still make the effort to keep in touch.

I did my best to keep in touch with Sam Johnson, too. In 1966, while I was working on the Gemini program, Sam flew in Vietnam. During his 25th combat mission, he was shot down and was incarcerated in a North Vietnamese prisoner of war camp, a place so desolate, with such inhumane living conditions and treatment so despicable, that he later described it as "Alcatraz."

During the war, many Americans back home wore bracelets reminding us of captured soldiers wallowing in the sweltering POW pigsties in 'Nam. I wore a metal bracelet with Sam's name, rank, and serial number engraved on it, along with the date that he was shot down. It was a symbol of hope and solidarity with our troops. I wore that bracelet to the Moon and back.

Sam didn't know that I had been on Apollo 11, because he had been kept in the dark in the Vietnamese POW camp. Even when he heard the news over a crackling radio in the prison camp that human beings from America had walked on the Moon, Sam's Vietnamese captors tried to convince him that it never happened, that it was, in fact, the Russians who had landed on the Moon. Sam refused to believe what his tormenters were telling him. My good friend Sam endured

seven years as a POW in Hanoi, including 42 months in solitary confinement. It wasn't until after his release from the Vietnamese POW camp that Sam learned that his former wingman buddy had walked on the Moon.

Sam served our country in the U.S. Air Force for 29 years, flying with the precision demonstration team, the Thunderbirds, as well as on combat missions in Korea and Vietnam. Later he ran for office in the Texas state legislature, and then he went on to become a multiple-term U.S. congressman, serving the third district of Texas.

After years of separation, we reconnected, and we still keep track of each other to this day. I regard Sam as one of the best friends I've ever had and one of the best men I've ever known.

You never know how people you meet today will have an impact on your future. Another friend that I first met in Korea played a significant role in my future, because of his impact on the space program. His name was John Glenn, the Mercury program astronaut who in 1962 first orbited the Earth three times, which in the early days of America's space program was a major accomplishment. John and I flew F-86 Sabre jets together in the waning days of the war, and he succeeded in shooting down three Russian MiGs near the Yalu River, one more than I did.

Regarding his initial spaceflight, John later quipped, "As I hurtled through space, one thought kept crossing my mind: Every part of this rocket was supplied by the lowest bidder." He went on to become a U.S. senator representing his home state of Ohio. While still a sitting senator, at 77 years of age, John went back into space for a nine-day mission aboard the space shuttle *Discovery*, and to date he is the oldest person ever to travel into space.

John and I still share a passion for space exploration, although neither of us could have imagined such a thing when we first met in 1953. But your friends do rub off on you.

Serving my country in Korea was a marvelous time in my life. After chasing Soviet MiGs all day, my buddies and I

would gather together and tell our stories. We were intensely competitive with each other, but we also shared a special camaraderie, much like the relationships I would have with NASA astronauts a few years later. It was an experience like iron sharpening iron, similar to our time at West Point, where we brought out the best in each other. Eventually—often after a few adult beverages—someone would break into a song. We had an entire repertoire of fighter pilot songs that I still sing sometimes, even after all these years. And when I sing those songs, in my mind, I'm right back there in Korea with all those great friends.

Besides stopping the Soviet-supplied communists from North Korea in their efforts to overrun South Korea, the war also created a fringe benefit for America that often goes unnoticed. That is: Most of the early U.S. astronauts were not veterans of World War II. Most of us were fighter pilots who flew during the Korean War. In addition to the missions flown by John Glenn, Neil Armstrong flew 78 combat missions in Korea. Wally Schirra flew 90 missions; Gus Grissom flew 100 combat missions over Korea; Jim McDivitt flew 145 missions! And of course, I flew 66 missions chasing MiGs.

As fighter pilots in Korea, we learned concentration under fire, how to stay calm in the face of dangerous situations, and how to make quick, life-or-death decisions. Beyond that, because we knew that we were really fighting the Soviets as well as the North Koreans, the war spurred a passionate competition between the Americans and the Russians that would carry over into the space race. We were not going to let those "Russkies" beat us in Korea, and we were certainly not going to let them get the upper hand on us in space.

☾

YOU NEVER KNOW WHEN the next person you meet might be someone who impacts your life for the better, or someone to whom you can give a helping hand. Shortly after I moved to

Houston to become part of the U.S. space program, I was visiting with my friend Ed White when we saw a guy out roller-skating on the cement behind Ed's house.

"Who is that?" I asked.

"Oh, that's Neil Armstrong, another test pilot who has been accepted for the astronaut program."

I had heard plenty of stories about Neil already—that he was a fearless test pilot with a deadpan serious personality. "That's Neil Armstrong?" I asked, watching the roller skater. He didn't look too serious to me.

I knew that Neil had been a fighter pilot in Korea as well, so we had that experience in common, and we soon struck up a long, lasting friendship, one that some people would later misunderstand and misrepresent, but a friendship that Neil and I knew was based on mutual admiration. My friendship with Neil Armstrong became another positive factor in my life. Neil and I became even better friends when we were selected to work together as the backup crew for Apollo 8. Neil was a man of few words and enjoyed being the strong, silent type. I, on the other hand, enjoyed talking about our work and the possibilities ahead. But we hit it off and had a mutual respect and appreciation for each other. We were a good team. We worked closely together almost every day for six years, and although one of us would sometimes rub the other the wrong way, we always brought out the best in each other.

Neil and I were selected as the crew for Apollo 11 in January 1969. In some ways, *because* we were selected for the first landing mission to the Moon, it created an additional strain on our friendship. We both knew there would be enormous publicity around our mission and that everything we said or did would be all over the news. When some people at NASA questioned whether I was the right man for the job, Neil came to my defense. I knew that we worked well together, and I was glad to learn that Neil felt the same way. He was quick to defend a friend, and I've always been honored to be known as his co-worker.

Not long ago, I visited Purdue University, where faculty

and student researchers have been working with my Mars Cycler ideas—a system of spacecraft cycling between Earth and Mars, continually carrying people and materials in both directions. Outside the Neil Armstrong Hall of Engineering stands a large statue of Neil, who was an engineering student at Purdue in 1955. I slipped up next to the statue and cracked, "Hey, I want them to make a statue of me, sitting here beside Neil and holding his hand!"

Although all of the astronauts in training were extremely competitive, we were also friends. That made sense, because most other people couldn't really relate to our intense training, our level of commitment to the cause, and how passionately we pursued our goals of catching and passing the Russians in the exploration of space. Like any team, however, some of us clicked with each other better than others. One of the guys that I became closest to was Ed White.

Ed was a year behind me at West Point, and he and I were on the track team together and became best friends during our time at the academy. Ed enlisted in the Air Force upon his graduation in 1952. He spent three years in Germany, and he was stationed there when I arrived at Bitburg following my stint in Korea. I was stationed in Germany from 1956 to 1959, and during that time, our friendship grew even stronger.

Like me, Ed loved flying the F-86 Sabre jets as well as the incredible F-100 fighter jets in the "Big 22 Squadron" that made regular runs close to the "Iron Curtain" nations, the countries under Soviet control. We were carrying a nuclear payload, and we were ready to attack the Russians at the first sign of a nuclear threat. The Russians had already steamrolled into Budapest, crushing any opposition, so we were constantly on alert to halt any further advances by the Soviet forces in Europe. Ed and I regularly flew practice missions, loaded with bombs we were ready to deliver.

Near the end of the decade, Ed became fascinated with space. Leaving Germany, he attended the University of Michigan and earned his master's degree in aeronautical

engineering the same year that NASA selected seven men as the original astronauts for Project Mercury, the first U.S.-manned space program. All seven of the initial astronauts were test pilots, so Ed enrolled in the Air Force Test Pilot School at Edwards Air Force Base in California. He was one of the pilots to fly the planes used for astronauts Deke Slayton's and John Glenn's weightless maneuvers, some of the first test flights to see how zero gravity affected humans.

As the Mercury flights concluded, NASA began recruiting a new crop of astronauts for Project Gemini. Drawing from more than 200 applicants, NASA selected Ed White and eight more test pilots: Neil Armstrong, Frank Borman, Charles Conrad, Jim Lovell, Jim McDivitt, Elliot See, Tom Stafford, and John Young. Even among this group of superachievers, Ed stood out from the crowd. Moving to Houston, like several other astronauts including me eventually, Ed and his wife, Pat, bought a home in El Lago, to be close to the Manned Space Center. More than any other person, Ed White was the friend who encouraged me to apply to NASA to become an astronaut.

He first went into space on the Gemini 4 mission, and on June 3, 1965, Ed was the first American astronaut to perform a successful extravehicular activity (EVA), a space walk outside the capsule for 21 minutes. A devout Methodist, Ed carried three religious reminders with him when he stepped out of the hatch—a gold cross, a Star of David, and a St. Christopher's medal. He later quipped, "I had great faith in myself, and especially in Jim [McDivitt, the mission's commander], and I think I had great faith in my God … The reason I took these symbols was that this was the most important thing I had going for me, and I felt that while I couldn't take one for every religion in the country, I could take the three I was most familiar with."

Besides his incredible courage, Ed had a great sense of humor. Before stepping out in space, using a handheld maneuvering gun and attached to the spacecraft by a tether, Ed checked his 35mm camera equipment three times. He said, "I wanted to make sure I didn't leave the lens cap on!"

Far too quickly, in Ed's estimation, his space walk came to an end. "I enjoyed the EVA very much, and I was sorry to see it draw to a close," he said.

Following his outstanding Gemini EVA, Ed was selected as senior pilot for Apollo 1, scheduled for launch on February 21, 1967, as America's first mission in the program that would eventually take us to the Moon. Unfortunately, as Ed, Gus Grissom, and Roger Chaffee trained and prepared, it seemed they encountered one setback after another. Finally, everything started to come together, each problem solved, so on January 27, 1967, NASA planned a "plugs out" test, a full dress rehearsal for launch, in which the Apollo 1 capsule would be unplugged from external power while the astronauts practiced emergency escape procedures.

Ed sat in the middle seat, and it was his responsibility to reach above his head with a ratchet to loosen the bolts of the hatch. The hatch door was heavy, but Ed was a strong man and in excellent physical condition. He had practiced the egress drill numerous times, although never within the 90 seconds suggested by NASA's engineers.

They started the drill around 1 p.m. and encountered more problems, including a communications microphone that would not turn off. The three astronauts were still inside the space capsule, perched atop the enormous Saturn rocket standing on Launch Pad 34, as darkness began to shroud Cape Canaveral.

It was then that something went horribly wrong. With all three astronauts buckled into their seats, and with a highly flammable, 100 percent oxygen–rich atmosphere inside the command module and flowing through their space suits, a fire broke out in the capsule. Investigators later thought the fire was caused by some sort of voltage surge or possibly an electrical short that produced a spark below the left equipment bay under Gus Grissom's seat.

Like a blowtorch, the capsule erupted in flames. Just as he had trained, Ed White struggled to open the hatch, but this time, it was not a test and the astronauts did not even have the 90-second wiggle room. Within a minute, the command

module ruptured, causing an outrush of gases and creating an inferno inside the capsule, followed by deadly concentrations of carbon monoxide. The three astronauts trapped in the wall of fire never had a chance.

Ironically, none of our previous astronauts in the Mercury or Gemini programs had ever incurred a scratch, and NASA's most horrific space program accident took place not in space, but while the astronauts were still on the launchpad at Cape Canaveral. The Moon, which had seemed within reach a few hours earlier, now seemed out of sight.

Ed was my good friend and colleague; he was also a major part of my inspiration to become an astronaut. In a couple of minutes, his storied life was over. I never had a chance to thank him for all that he had meant to me, or to tell him goodbye, although two and a half years later, I carried with me to the Moon a medallion in his honor. In some way, I have tried to honor Ed by the path that I have pursued.

Life is a gift, and none of us has any guarantees about tomorrow, so don't miss the opportunity to tell your friends and family members how much they mean to you. Take the time to make that phone call just to say hello, or to write that note of encouragement.

In this day of text messages, email, and social media communications, if you really want to make an impression on someone, write a handwritten note of thanks or encouragement.

☾

OVER THE YEARS, I'VE BEEN PASSIONATE about trying to reunite all of our Apollo astronauts, but it has not been easy to get everyone together. I want them to care as much as I do. Some of them may feel that they no longer have much to contribute to the space program, so they aren't as interested in talking about future exploration. On the other hand, I feel that I'm not done yet.

Apollo astronauts were friends, but it was tough to

maintain a sense of normalcy, especially for the crew of Apollo 11, the first mission to land on the Moon. Most of the other guys in the Apollo program have remained close with their particular crews, but Neil, Mike, and I had a tougher time of it. At one point, Neil and I went years without seeing each other. Although we remained friends, we rarely got together socially, except at special U.S. presidential commemorations of the Apollo 11 mission, which have taken place at the White House every five years since the initial landing on the Moon.

Mike Collins and I still keep in touch, although at the beginning of every phone call, Mike is always quick to remind me, "Buzz, I don't want to talk about Mars!"

"Okay, right, Mike. But you know that scientists at Purdue University have now proven that my Mars Cycler will work …"

"Buzz!"

On a trip to Arizona, I was talking with Gene Cernan, commander of Apollo 17 and currently known as "the last man to walk on the Moon," about the future of space exploration, and I was getting on his case. "Gene, why are you advocating that we go back to the Moon? We don't need to be competing with other countries to go to the Moon. Don't you realize that we don't have a big budget, and we'd be wasting money, time, and energy?"

"Buzz, I don't know what you know. All I know is that I think we need to be going out farther into space."

"We've got to find a way to go beyond the Moon," I prodded him.

"I don't know anything about that, Buzz. You obviously know much more than I do. All I know is that we need to be out there."

"So you admit that you know nothing!"

Even today, when any of the Apollo astronauts get together, there is a strong sense of camaraderie mixed with a very real sense of competition. Of the 24 Apollo astronauts that reached the Moon, 12 of us actually landed on the Moon's surface. Yet, after nearly half a century, we are still

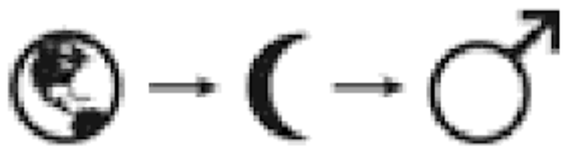
competitive with each other. It's a strange brew, but we cherish our friendships, and just as iron sharpens iron, we continue to bring out the best in each other.

The late entrepreneur and motivational speaker Jim Rohn often said, "You're the average of the five people you spend the most time with." What he meant by that, of course, is that the people with whom you repeatedly choose to associate will have an enormous impact on you, either positively or negatively. That's why I say, Show me your friends and I will show you your future.

Choose friends who will bring out the best in you.

• CHAPTER FOUR •

SECOND COMES RIGHT AFTER FIRST.



On the television show *The Simpsons*, Homer asked me how it felt to be the second man on the Moon. I told Homer, "Second comes right after first."

Who wants to be number two? You never see a team running off the field after a game, shouting, "We're number two! We're number *two!*"

No, everybody wants to be number one.

Truth is, for years, I bristled at my notoriety, being known as "the second man on the Moon." My father even made strident efforts to get the official U.S. Postal Service stamp to say "First Men on the Moon," rather than "First Man on the Moon." The Postal Service opted for "First Man."

Making matters worse, in the "normal" patterns of NASA and the space program, I *should* have been the first person to walk on the Moon. Neil was the commander, and I was the pilot. The commander normally stayed with the spacecraft while the junior officer under his command left the spacecraft to perform the EVAs. The commander had an enormous responsibility, not to mention additional training requirements, so in all previous missions, if a crew member was to spacewalk, it was always the junior officer rather than

the commander. That was the way NASA had operated in every other launch prior to Apollo 11.

But NASA changed its procedures just prior to our launch. Neil, it was decided, would be the first person to set foot on the lunar surface. Once NASA decided that the mission of Apollo 11 would include an attempted landing, everything changed. We all understood that this would be different; besides being historic, two people would leave the spacecraft, not one.

When the word got out, several of my colleagues said, "This isn't right, Buzz. You should be the first one to set foot on the surface." Others, however, felt that the symbolism of the pioneer explorer arriving at his destination demanded that the commander of the mission be the first to set foot on the Moon.

Although I was excited about the possibilities of our mission, I wasn't interested in trying to manipulate opinions at NASA, or pushing to be number one. I had even expressed to my wife my misgivings about being a crew member on the first mission to the Moon, suggesting that I would rather be involved in a later trip to avoid the publicity and media frenzy and other hoopla that would most assuredly accompany the initial lunar landing. I had experienced a major dose of that sort of public spectacle after I returned to Earth following my successful space walk during Gemini 12. Although I was grateful for the many kind gestures and words expressed to me, the enormous amount of attention I received everywhere I went was overwhelming. I could barely step outside our home without being swarmed by media or fans. Nor could my mother. I'm convinced that the emotional overload following my Gemini success was a major factor in my mother committing suicide the year before I went to the Moon. That's why, given a choice, I would have preferred a later mission rather than the initial landing.

Moreover, I felt sure that later missions would focus on more experiments, and that possibility intrigued me. But Neil, Mike, and I had been the backup crew for Apollo 8, so when our rotation came up for Apollo 11, it was our turn,

whether or not the mission turned out to be the first attempt at landing.

Neil took his commander responsibilities seriously. Too seriously, sometimes, for Mike and me. Mike has a great sense of humor and loves to laugh. Neil was much more serious and "dignified."

When Neil took that first "small step for man, one giant leap for mankind," he was still grasping the lunar module (LM) ladder, and his right foot remained on the LM footpad. Because scientists had no idea how deep the lunar dust might be, he tentatively placed his left foot on the surface, trying to determine if it would support his weight. It did. In fact, the LM footpads had only depressed the lunar surface about one or two inches. That was good news. Some scientists were concerned that the LM's landing pads might sink deeply into the dust, possibly tilting the LM or even toppling the landing craft on its side. But the surface held firmly. Neil's boot sank into the dust less than a quarter of an inch.

I wasn't certain what Neil would say when he first set foot on the Moon, but I was quite sure that it would not be some serendipitous statement that just popped into his mind. We were intensely aware that every move we made and every word we spoke on the Moon would be seen and heard by untold millions of people, possibly for generations to come. But I really had no idea what Neil might say the moment he first set foot on the Moon. Even as we approached the Moon, still in the command module, Mike attempted to pry the secret out of Neil, asking him questions such as, "What are you going to say when you get down there?"

"Oh, I don't know," Neil said, playing down the significance of his initial statement. "If our mission is successful, I'll think of something."

I smiled, knowing that whatever Neil decided to say, it would be well thought out and appropriate to the moment.

It was. "That's one small step for man, one giant leap for mankind," Neil proclaimed, and he was right.

About 20 minutes later, it was my turn. With Neil already on the surface and snapping photos of me, I carefully backed

down the ladder and partially closed the hatch, making sure not to lock it on my way out! As I stepped onto the talcumlike lunar dust, the first words that came to mind were: *magnificent desolation.* It was a "magnificent" accomplishment for man to set foot on another world for the first time. And yet there was the "desolation" of the million-year lunar landscape with no signs of life, no atmosphere, and total blackness beyond the sunlit terrain.

Nearly a billion people all over the world watched and listened as Neil and I ventured onto the powdery lunar surface. Houston was in constant communication with us, so even though we were farther away than any two humans had ever been—except for Mike, who was circling the Moon in *Columbia*—we felt connected to home.

We spent two and a half hours on the surface—collecting rocks, setting up experiments that NASA could continue to monitor for years, and taking a few photos.

Because the camera was attached to a fitting on Neil's space suit, he took most of the photographs on the Moon, and he did an excellent job, although the photos were both a blessing and a curse. After setting up one experiment, we weren't supposed to walk in front of it, but the photos later revealed my footsteps to the right of the apparatus. Because Neil was taking the photo and there was nobody else up there, I was guilty as charged—or, as someone might say, the photo revealed "condemning evidence."

One photo that Neil took of me later became known as the "Visor Shot," one of the most famous photographs in history. At first glance, it seems like a simple picture of me standing on the rough lunar surface with the blackness of space behind me. If you look more closely at the reflection in my gold helmet visor, however, you can see the *Eagle* spacecraft, my shadow on the Moon, some of the experiments we set up, and even Neil taking the picture—all in the visor of my helmet. It is truly an astounding photograph. In one click of the camera shutter, Neil captured man's first walk on the Moon. Over the years, people have often asked me why this photo was so great. I answer with three words: Location,