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# Discovery

CHANNEL MAGAZINE



# YOUR NEXT JOB

HOW TO BECOME AN ASTRONAUT

16-PAGE SPECIAL  
PG 36

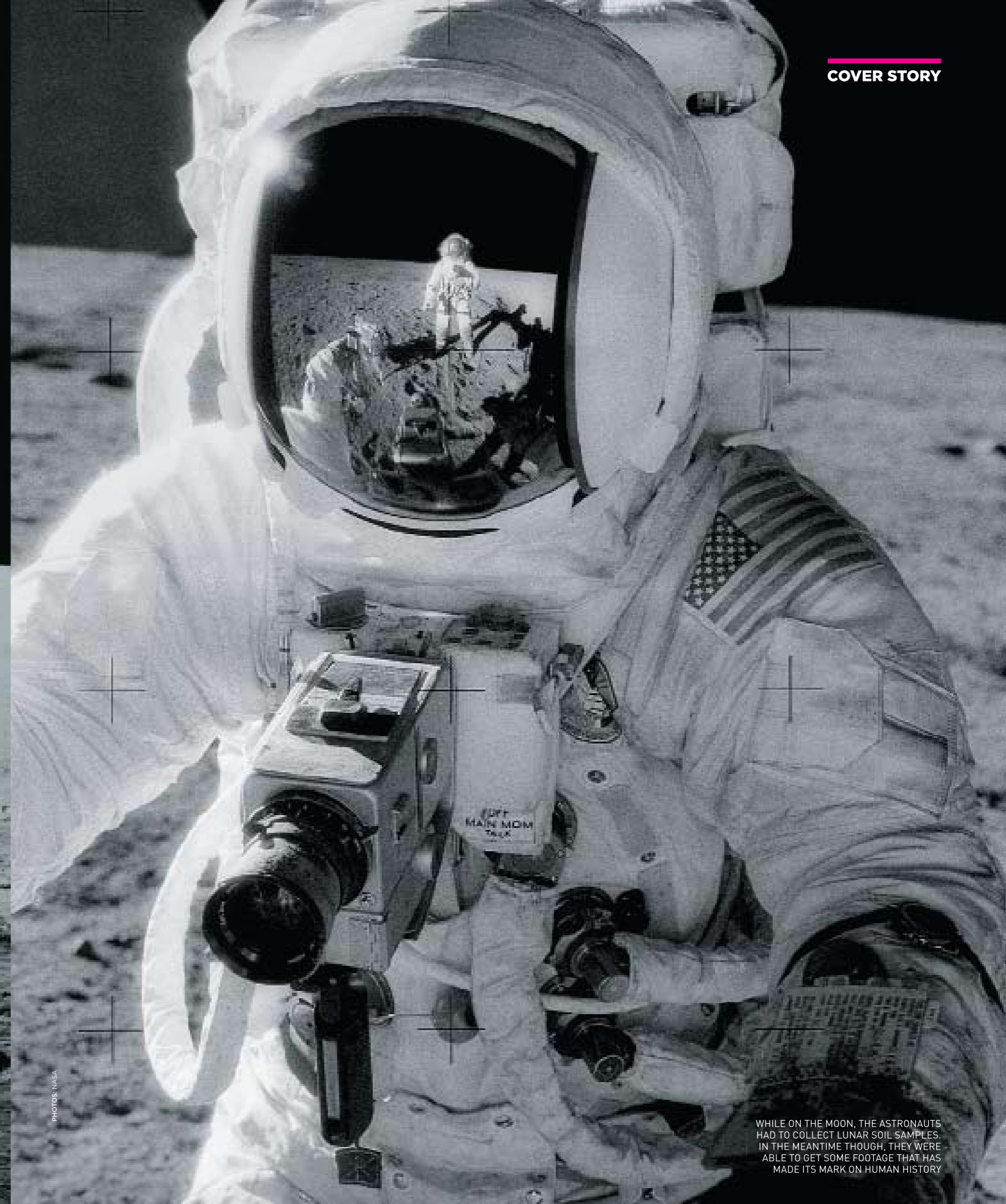
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# SO YOU WANT TO BE AN ASTRONAUT

No matter how much time has passed, our fascination with working above the earth remains. Space is still the final frontier, and the job of an astronaut remains a vocation with a unique allure. **Chris Wright** speaks to real-life moonwalkers to find out what it takes, and takes out of you, to work in space



PHOTOS: NASA

WHILE ON THE MOON, THE ASTRONAUTS HAD TO COLLECT LUNAR SOIL SAMPLES. IN THE MEANTIME THOUGH, THEY WERE ABLE TO GET SOME FOOTAGE THAT HAS MADE ITS MARK ON HUMAN HISTORY

“Ever replaced a gyro on an orbiting telescope travelling at 17,600 miles per hour in a full vacuum?” There

just aren't enough recruitment advertisements like the opening lines of NASA's guide to employee benefits for its next intake of astronaut candidates — which is open for applications right now. Being an astronaut has been a dream to young people ever since the dawn of the Mercury and Vostok programmes. For just a select few, it can also be a reality.

Have you got what it takes to be an astronaut, and what do you need to become one? To find out, we have assembled some of the most knowledgeable voices imaginable: the head of astronaut selection at NASA, and two of the original 12 men who not only ventured into space, but walked on the surface of the moon. If they cannot tell you how to land that internship to space, nobody can.

### THE GLAMOUR

“I was naked, lying on my side on a table in the NASA Flight Medicine Clinic bathroom, probing at my rear end with the nozzle of an enema. Welcome to the astronaut selection process, I thought.” So wrote Mike Mullane, who flew on three Space Shuttle missions.

For astronauts, the rewards of their missions are almost unimaginably good. These include feasting their eyes on sights few others will ever enjoy, and a chance to be part of the history of human endeavour. “Going to the moon and back was an impossible dream,” says Alan Bean, the fourth man to walk on the moon on the Apollo 12 mission. “It still is.” But Bean saw it. He lived that impossible dream.

Yet all who have worked in the space corps stress that there is also lot of hard work, discomfort and a surprising amount of boredom involved in getting there. To live the dream, you also have to take the drudgery. Bean had one of the most stellar careers of all astronauts. As well as Apollo 12, he was mission commander on the second manned flight to the Skylab space station, and set a then-record for time in space. But over an 18-year career at NASA, he went into space just twice. Many fly once in an entire career. Vastly more time is spent waiting than adventuring.

“It was very frustrating. Other people in my group were flying and I was not,” Bean told *Discovery Channel Magazine* from his Houston studio in the US state of Texas,

where today he paints his memories of the lunar surface. “I felt that I was not measuring up to the guys who were being selected.” The waiting game has long been the case for potential astronauts, even during the Apollo era when candidates tended to be fearless, hot-blooded test pilots from the United States Navy and Air Force, living for nothing more than the dream of leaving the atmosphere.

“Even in the early days there was a lot of preparation that went into a flight. It was not just ‘let's go strap it on’,” recalls Charlie Duke, the tenth man to walk on the moon on Apollo 16, and selected while he was a test pilot under legendary aviator Chuck Yeager. “For an astronaut, patience was a good character trait. You needed to wait your turn.” Duke waited six years between selection as an astronaut candidate and flying in 1972 — his only flight into space.

How do you get into that queue in the first place? Nowadays, it is no longer like Bean and Duke's time, when you had to be a pilot, and male, to even stand a chance. For NASA at least, a surprisingly broad range of people are now under consideration. Key to the equation is education. “To get to this astronaut selection office, you have to come through the door of the Johnson Space Center,” says Duane Ross, the current head of the astronaut selection board at NASA. “But that is the second door. The first is the door to the school building.”

While NASA no longer requires doctorate-level degrees, as it did when the focus shifted from pilots to scientists in the late 1960s, it does require an undergraduate degree in engineering, science or mathematics. You no longer

**“IN OUR LUNAR MODULE SIMULATOR I PROBABLY LANDED ON THE MOON 2,000 TIMES OVER THE TIME I WAS THERE”**

need to have flight experience, which can be acquired later, and you certainly do not need to have been in the armed forces.

“As the Shuttle progressed, fewer and fewer who were selected were pilot astronauts,” recalls Duke, who was around for the early years of the Space Shuttle programme. “There were more mission specialists and payload specialists. Plus, of course, 50 percent of the competition was cut out for my generation, because no women were allowed.”

Potential candidates are now more likely to be restricted by health, which obviously must be good, and by height, than by the ability to fly a plane. The earliest Mercury and Gemini-era astronauts could be no



PHOTO: NASA

ABOVE: THE APOLLO 16 ASTRONAUTS, CHARLIE DUKE AND JOHN YOUNG, DURING LUNAR ROVER TRAINING

### PASSPORT IN SENEGAL

When Space Shuttle flights departed from Cape Canaveral in the US state of Florida, they had an option of a transatlantic landing if one engine failed, which on some launches would put them in Dakar, Senegal. To deal with this possibility, one astronaut would be sent all the way to Dakar International Airport, along with the crew's passports and Senegal visas. Mike Mullane wrote: “I had a vision of standing in the customs line at Dakar airport in our shuttle flight suits with our helmets in the crook of our arms, while a bureaucrat asked, ‘Anything to declare?’”

## CHARLIE DUKE'S FAMOUS LINE

If you don't know astronaut Charlie Duke by name, you probably know his voice. One of the most famous radio exchanges in history took place when Neil Armstrong piloted Apollo 11 onto the surface of the moon for the first time in 1969. Having found his planned landing site unsuitable, he flew over a crater and was almost out of fuel when he finally touched down. “Houston, Tranquillity Base here, the Eagle has landed,” said Armstrong. A broad southern drawl responded: “Roger, Twanq... Tranquillity, we copy you on the ground. You got a bunch of guys about to turn blue. We are breathing again.” That was Duke, serving as CAPCOM (capsule communicator) on the ground in Houston.

Today, he recalls, “The actual moment of landing was one of intense relief. I remember the tension in mission control was the highest I have ever felt it. There was dead silence, which was extremely rare, as people focused on their consoles. When Neil came back and said ‘The Eagle has landed’, it was like a balloon popping in mission control. I was so excited I couldn't even pronounce ‘tranquillity’. And it was true. We were holding our breaths waiting for that landing.”

## THE WORLD-FAMOUS CASE OF MEASLES

Charlie Duke had one of the world's most famous cases of German measles. In inadvertently exposing his colleague Ken Mattingly to the illness, he caused Mattingly's withdrawal from the Apollo 13 mission just three days before its ill-fated launch. It would have been him, rather than replacement Jack Swigert, who flicked the switch that caused the craft's oxygen tank to explode, triggering the most audacious rescue in history. Mattingly still got to fly to the moon, only on Apollo 16 instead — with Duke, the man who exposed him to the measles in the first place. Which, incidentally, Mattingly never got.

taller than 1.8 metres, to fit into the tiny one-man capsules. Even today the height limit for the latest NASA intake is between 1.57 and 1.9 metres, with requirements on arm and leg length too, to ensure you can fit in the Russian Soyuz capsules that NASA currently has to use to take astronauts to the International Space Station (ISS) since the Space Shuttle programme stopped. "If you are going to fly in space, you have got to fit in the spaceship," says Ross.

Nationality is still an issue: NASA only accepts American citizens. But it is no longer like in the 1960s, when only a Russian or American could hope to go into space. Today, people from 38 nations have flown in space, and there is every chance that the next person to set foot on the moon could be from China.

### DON'T GIVE UP

The next thing you need is persistence. The first time Bean applied for the Apollo programme, he was rejected. "They didn't ever tell me why," he recalls. But he noticed everyone who was selected was older and more experienced than him, so he just got more experience and applied again, this time successfully.

In his view, it was not just a question of being top of the class — which he was not, either academically, or as a pilot. "You need to be of a certain IQ so you can learn things quickly, but you do not have to be the smartest guy in the class. You have got to be able to get along with all sorts of other people, and not everybody can do that either. You do not just hire a valedictorian, and hope they work out."

Some NASA intakes have attracted 8,000 applications, and the last time, 3,500 people applied. A hundred and thirteen were interviewed, 48 got to a second interview — and just nine were hired. "There are two messages," Ross says. "One, it is very competitive. But two, the one guarantee is



PHOTO: NASA

### ADVICE FROM THE MAN

Nobody's advice is more relevant than the man in charge of astronaut selection. So, Duane Ross, what should budding astronauts do? "A good education will help you whether you get to be an astronaut or not. Getting into science and engineering is a good place to be. Also, it is not just academics; be well-rounded, do lots of things, show teamwork, and enjoy working with other people in different situations and environments." So far NASA has selected 330 astronauts in total since 1959.

ABOVE: THE APOLLO 12 ASTRONAUTS, INCLUDING ALAN BEAN, SUIT UP FOR A PRACTICE EXERCISE KNOWN AS THE COUNTDOWN DEMONSTRATION TEST

that if you do not apply, you cannot get picked." Like Bean, he stresses that being a genius is not the whole point. "It is pretty simple: you need nice people. The world's best scientists or pilots may not be the team players you need to go fly in space, particularly now we are flying six months on the ISS. There is a huge personal aspect to this."

Once selected, the study is intense. Ross describes it as "kind of like getting a doctorate degree in being an astronaut in a two-year period." On the menu are training to understand ISS systems, competence at flying (in NASA's case in T-38 jets), land and water survival training, spacesuits, EVAs (extra-vehicular activity, or spacewalks), robotics on board, and mastery of Russian.

Parts of this are guaranteed to set the pulse racing: the jet flying, the simulators, the so-called Vomit Comet flights that simulate weightlessness. There is plenty of work in heavy spacesuits in deep swimming pools.

There is, though, a lot of repetition. "In our lunar module simulator I probably landed on the moon 2,000 times over the time I was there," reminisces Duke. "I crashed it a few times too. But in the one that counted, we pulled it off." In his case, one almost unique branch of training was the lunar rover, which he and John Young spent much of their three days on the moon driving around at what looked a fair old clip (in fact 18 kilometres an hour, the record for the fastest land speed attained on the moon).

### LIFE IN SPACE

So you have waited the best part of a decade for your chance. You are on the launch pad, ready to go. What should you expect?

Let's deal with the obvious one first. Apollo veterans say the question they still get asked most frequently today is how you go to the bathroom. "When you are on the moon and you've gotta go, you've gotta go," Duke says. "You do not run over to the nearest restroom and say 'excuse me'." In Duke's day, when he



## SPACESUIT EVOLUTION

As technology advanced in leaps and bounds, spacesuits in the NASA space programme were constantly improved upon. They were made of better material, were lighter and less bulky — and even managed to (sort of) look good



### MARK IV SUIT LATE 1950s

THE UNITED STATES NAVY MARK IV HIGH ALTITUDE PRESSURE SUIT WAS MADE AT THE REQUEST OF THE US NAVY. LIGHTER THAN PREVIOUS SUITS, IT HAD JOINTS THAT ALLOWED THE WEARER GREATER MOBILITY IN THE ARMS, LEGS AND WAIST. NASA OBTAINED IT FROM THE US NAVY FOR ADAPTATION INTO SPACESUITS FOR THE MERCURY PROGRAMME



### MARK V SUIT EARLY 1960s

THIS IS A DEMONSTRATION MODEL OF THE SUIT B.F. GOODRICH MADE FOR THE SPACE PROGRAMME. THE SUIT HAD A DEVELOPMENTAL ARM WHICH BOASTED A LARGE CONVOLUTED SHOULDER THAT PROVIDED INCREASED MOBILITY. UNFORTUNATELY, ITS AWKWARD SIZE MADE IT IMPRACTICAL FOR ASTRONAUTS SQUEEZING INTO CRAMPED SPACECRAFT



### DEVELOPMENTAL G2-G PRESSURE SUIT 1960s

THIS PROTOTYPE WAS AN IMPROVEMENT FROM PREVIOUS MODELS WITH THERMAL AND RADIATION PROTECTION THAT ALLOWED FOR LONGER FLIGHTS AND POSSIBLE EXPOSURE TO OPEN SPACE. HOWEVER, NASA SELECTED ANOTHER SPACESUIT PROTOTYPE FOR PRODUCTION, AND THIS ONE WAS RELEGATED TO THE NATIONAL AIR AND SPACE MUSEUM, LOCATED IN THE US STATE OF WASHINGTON



### FREEDOM 7 SPACESUIT 1961

THIS IS THE SPACESUIT THAT WAS WORN BY ASTRONAUT ALAN SHEPARD DURING THE FIRST EVER MANNED SPACEFLIGHT LAUNCHED BY THE UNITED STATES IN MAY 1961. THE SUIT WAS A CLOSE-FITTING, TWO-LAYER, FULL PRESSURE SUIT, AND WAS DEVELOPED FROM THE MARK IV PRESSURE SUIT COMMISSIONED BY THE US NAVY. IT WAS SELECTED BY NASA FOR USE IN PROJECT MERCURY IN 1959

## NASA HEROES

A brief background on DCM's two new favourite astronauts:

### ALAN BEAN:

First flew into space on the Apollo 12 mission, in 1969

Fourth man to walk on the moon

Has spent 1,671 hours in space

### Cool Points:

Before becoming an astronaut, he flew in a jet attack squadron, after which he was a United States Navy test pilot

Now spends his time painting with moon dust, as well as using the hammer used to pound the American flag into the moon to add texture to his work. In fact, he has completed five paintings of fellow astronaut Charlie Duke

### CHARLIE DUKE:

Was CAPCOM (capsule communicator) during the Apollo 11 mission

Served on Apollo 16, becoming the tenth man on the moon in 1972

Has logged 265 hours in space, including 21 hours of extra-vehicular activity working outside the spacecraft

### Cool Points:

Has logged 3,632 hours in jet aircraft as a United States Air Force pilot

Has the rank of retired Air Force Reserve Brigadier General

In response to moon landing hoax theories, he replied, "We've been to the moon nine times. If we faked it, why would we fake it nine times?"

was getting dressed in the lunar module to prepare to step onto the moon, the first thing he had to put on was something called an FCD, basically a diaper, followed by another similar gadget for urine.

By the Shuttle era, flight suits for take-off and spacewalks featured a sort of condom that male astronauts would apply before flight to take care of their urine. Creating a similar system for women has been an enduring challenge. One of the biggest problems shuttle astronauts talk of is when they are still on the ground, strapped on their backs, facing upwards, for several hours as the various checks are conducted during countdown. The condom-like device is all well and good, but try urinating directly upwards when strapped down on your back.

On board orbiting craft or space stations, things are a little easier, with functioning toilets that never existed in the Apollo era, when they had to do their best to persuade their waste to descend into bags in a zero-gravity environment. "This bag," says Duke, "is not a triumph of technology, believe me."

Zero gravity is said to be a magnificent, freeing, euphoric experience, but it brings some curious reactions. Duke recalls zero gravity as "really fun, but at first very uncomfortable. Your head throbs with every heartbeat, your sinuses fill up; it is like having a head cold. But within hours, everything adjusts." Odder still, astronauts routinely become taller in space, a consequence of the vertebrae of the back stretching out. "I grew about an inch and a half [3.8 centimetres] on my way to the moon," Duke recalls.

Bean went into uncharted territory when he went 59 days in space on Skylab. "My concern to begin with was that we would get weaker and weaker as time went on," he says. Much effort was spent on working out an exercise regime. "We began to understand what humans can do, which

is why now they can go up on stations for six months or more, and be okay when they come home." This has given him some ideas about space tourism: "Someday when passengers go up in space, they are going to have to spend an hour a day with a physical trainer. If one says 'I feel sick today', the captain's going to say, 'You have a choice. Exercise, or you go in the brig. Otherwise when you get back you are going to die, and then blame it on me.'"

### NO FEAR

One thing early astronauts speak very little about is fear. It is very much the Apollo-era way to be deadpan about death. (Duke on the parachutes on his returning capsule after re-entry: "Without those chutes, we would have hit the water at a great rate of speed that would spoil your whole day.")

But both Duke and Bean had every reason to be fearful. Bean's ship was hit by lightning in the first minute of its ascent, prompting Pete Conrad's famous remark: "The flight was extremely normal for the first 36 seconds and after that it got very interesting." One of its guidance systems was knocked out. And before his flight, Duke had seen the dangers while on the back-up crew of Apollo 13, which suffered an explosion and came within a whisker of losing its crew before a rescue even more remarkable than the flight itself.

But they were well trained and knew the odds. "We knew about risk before we joined up; we had been doing things like that in airplanes for our whole career," says Bean. "Some who were not so good at it got killed. You have to have luck. Look at Challenger: no matter how good an astronaut you are, [in that situation], you are going to get killed." He recalls Neil Armstrong saying he had a 90 percent chance of coming back alive and a 50 percent chance of making a landing. Asked about his thoughts (*Continues page 46*)

## OFFICE POLITICS ON THE MOON

Even in the glorious Apollo era there was office politics when astronauts were jostling for assignments on to lunar crews. Alan Bean, prior to his assignment on Apollo 12, decided he must have been failing to show his good qualities to Deke Slayton and Alan Shepard, the Mercury 7-era astronauts with the greatest power in assigning Apollo crews.

"If I had my time over, I would learn to hunt and go hunting, because Deke was a big hunter," he says. "There is politics in everything, it is just the way it is."

Looking back, he thinks he was impeded by his tendency to go to Shepard and Slayton with occasionally crazy ideas. His colleague and mentor Pete Conrad, who would be commander on Apollo 12, told him to keep the weirder ones to himself. "I learned to shut up. It worked out okay."

Today, Bean thinks the differences in his approach serve him well. For instance, in his painting he uses moonboot soles and a lunar hammer to give texture to his creations. "If Al and Deke had been on my committee as a painter and I had told them that, they would have said: that is a crazy idea, Bean. They would be looking at me like: 'That is really stupid.'"

**BEAN RECALLS NEIL ARMSTRONG SAYING HE HAD A 90 PERCENT CHANCE OF COMING BACK ALIVE AND A 50 PERCENT CHANCE OF MAKING A LANDING**

PHOTO: NASA



### FRIENDSHIP 7 MERCURY SPACESUIT 1962

JOHN GLENN WAS PROTECTED DURING THE FIRST ORBITAL FLIGHT OF AN AMERICAN ASTRONAUT IN FEBRUARY 1962 BY THIS SUIT. IT WAS DEVELOPED BY THE B.F. GOODRICH COMPANY, BASED ON THE US NAVY MARK IV PRESSURE SUIT. GLENN'S FLIGHT LASTED FOR ALMOST FIVE HOURS, DURING WHICH HE ORBITED THE EARTH THREE TIMES AND TRAVELLED ALMOST 122,000 KILOMETRES



### MODIFIED B1-A PRESSURE SUIT LATE 1960s

THIS IS AN EXPERIMENTAL ADVANCED EXTRA-VEHICULAR SUIT THAT WAS CONSTRUCTED IN THE LATE 1960S. THE EXTERIOR OF THE SUIT IS MADE OF A MATERIAL CALLED CHROMEL-R, A PROTECTIVE LAYER THAT WAS APPLIED TO PARTS OF THE APOLLO SUITS, GLOVES AND BOOTS. ACCORDING TO EXPERTS, THIS IS THE ONLY SPACESUIT KNOWN TO HAVE BEEN COVERED WITH CHROMEL-R



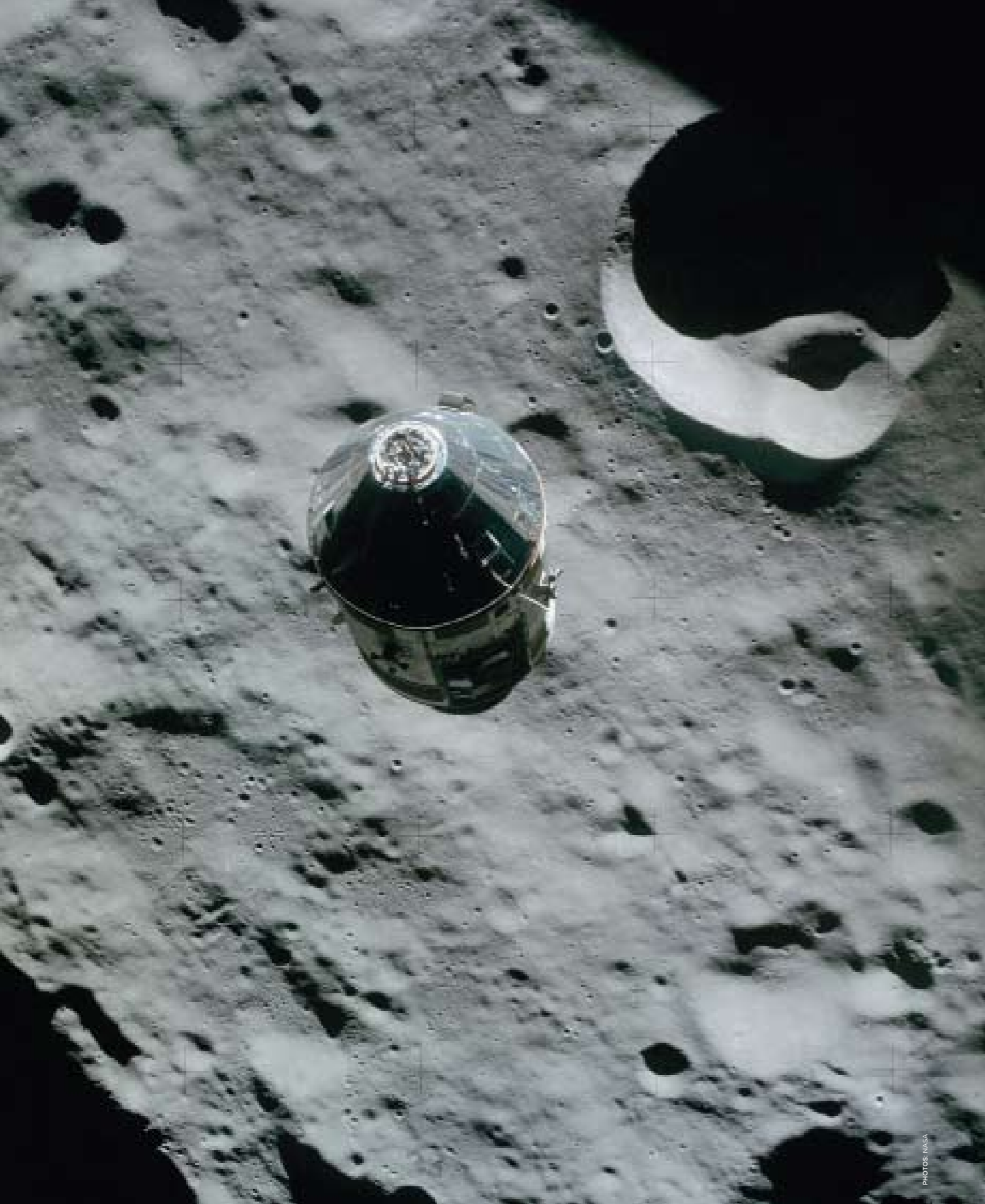
### APOLLO A7-L SUIT 1971

WORN DURING THE APOLLO 14 MISSION IN JANUARY 1971, THIS SUIT WAS DESIGNED AND CONSTRUCTED BY THE INTERNATIONAL LATEX CORPORATION TO ALLOW FOR EXTRA-VEHICULAR ACTIVITIES, OR SPACEWALKS. WITH THE PORTABLE LIFE SUPPORT SYSTEM AND ALL THE OTHER COMPONENTS THAT MADE SPACEWALKING POSSIBLE, THE SUIT WEIGHED AROUND 82 KILOGRAMS HERE ON EARTH

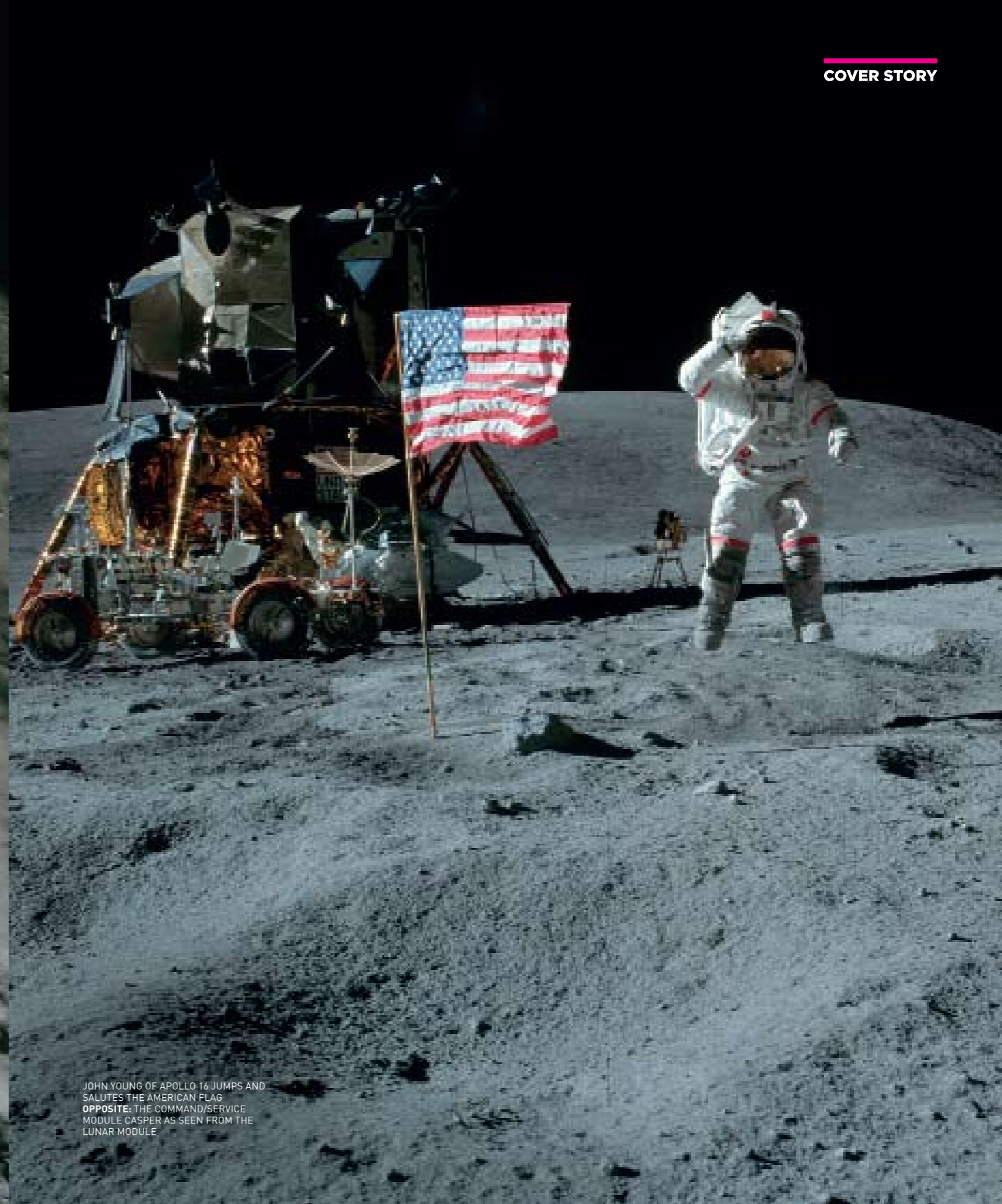


### A7-LB PRESSURE SUIT 1973

MADE FOR AND WORN BY ALAN BEAN FOR THE SKYLAB MISSION, THE A7-LB WAS DESIGNED TO PROVIDE A LIFE-SUSTAINING ENVIRONMENT FOR THE WEARER DURING SPACEWALKS OR WHEN THE CRAFT WAS OPERATING IN UNPRESSURISED MODE. THE SUITS WERE MADE TO PROVIDE MAXIMUM MOBILITY AND COULD BE WORN RELATIVELY COMFORTABLY UP TO 115 HOURS. WE CAN'T VOUCH FOR HOW THEY SMELLED AFTER THAT



PHOTOS: NASA



JOHN YOUNG OF APOLLO 16 JUMPS AND SALUTES THE AMERICAN FLAG  
**OPPOSITE:** THE COMMAND/SERVICE MODULE CASPER AS SEEN FROM THE LUNAR MODULE



## CHANGING POLITICS

It is no secret that the Apollo missions were launched primarily to beat Russia at something; they were a function of the Cold War. "Apollo was a political decision in the beginning: a race to space with the Russians," Charlie Duke, Apollo 16 astronaut, recalls, though he said once selected, it was never really an issue. "The political context quickly changed to a scientific one."

Today US-Russia relations have improved so much that American astronauts must use Russian Soyuz capsules to get into space, and are expected to learn Russian in their basic training. Russian cosmonauts must learn English, and they do parts of their training in the United States.

If there is a space-race competitor today, it is China. "I do not have a sense of what China does at all," says NASA's Duane Ross.

While DCM tried, but could not reach the China Manned Space Engineering Office for this feature, there are numerous facts that are a matter of public record. The first Chinese man, Yang Liwei, flew to space onboard the Shenzhou 5 in 2003. China launched a module called Tiangong 1 into space in September 2011, followed



by an unmanned ship, Shenzhou 8, in the next month to dock with it. The first section of a Chinese permanent space station should be in place by 2015, with the full station complete by the year 2020, when

the International Space Station is due to retire. Further ahead, China has announced plans to send a man to the moon by 2025, to build a lunar observatory, and to send missions to Mars.

Increasingly, world politics are not going to matter (or at least, will matter less) as the business of space travel — particularly cargo and space tourism — passes from state-backed agencies such as NASA to the commercial world, into the hands of groups like Virgin Galactic, part of well-known entrepreneur Sir Richard Branson's Virgin Group.

Once it becomes viable to earn a profit from these ventures, we can expect space to become very crowded with private sector businesses.

(Continued from page 42) ahead of his own mission, Bean says his odds were "about the same. You have in your head these thoughts, but you think, is it worth it? Obviously, to us, it was worth it." Chillingly, he adds: "Losing two crews on the shuttle [Challenger and Columbia] was better than we thought. We thought we would lose more." It is a price crews are willing to pay to do what they love. "When you want to explore, it is not like the American public think it is. You are on the cutting edge of what you can do," says Bean.

For Duke, the one moment he recalls fear was somewhat comical. He and Young had spent three days on the moon and had achieved a great deal. It was almost time to go home, and with all their work done, in one-eighth Earth gravity, they decided to conduct their own Lunar Olympics and set the record for the high jump.

They began bouncing, then Duke fell flat on his back. You have probably seen the famous footage of Duke falling on his front earlier in the mission when attempting to conduct a drill experiment. But falling on your back was certainly a very different

**WHEN THEY GOT THERE AND OPENED THEIR CHECKLIST, THEY FOUND A BACK-UP CREW HAD ADDED A PICTURE OF A NAKED WOMAN, WITH THE NOTE: "SEE ANY INTERESTING HILLS OR VALLEYS?"**

deal. "That was scary," he says now. "That backpack was not designed for that kind of impact. If I split my suit open, I was dead." He survived — and his successful high jump record still stands.

Despite all that, there was always room for fun. Watching the footage of Duke and Young on Apollo 16, one is struck by how much they seemed to be enjoying themselves. "I'm glad that came across, because that is the way we felt," Duke says. "We decided we were going to do our job, to get everything accomplished, but enjoy ourselves. Enjoy this beautiful, exciting adventure."

One thing you cannot see in that footage is that Duke had a leaking valve in the drink bag within his suit as he walked on the moon. Frequently a globule of orange



PHOTOS: NASA; CLAIRE BROWN (RICHARD BRANSON)  
**ABOVE:** AS THE COMMAND MODULE CARRYING THE APOLLO 16 ASTRONAUTS HOME DESCENDS TO EARTH, PARACHUTES ARE DEPLOYED TO SLOW ITS VELOCITY



## MOON-WALKER

**CHARLIE DUKE, TENTH MAN ON THE MOON, TELLS US ABOUT HIS EXPERIENCES**

**In terms of character, what does it take to be an astronaut?**

The personality I would describe is one of adventure and curiosity. As a test pilot, the dream was: higher, faster, and let's see what it's like out there. That would describe my personality.

**What advice do you have for people wanting to become astronauts?**

Have a basic interest in science or engineering, and pursue that educational career. Most of the astronauts selected have a background in science and engineering. Then study hard, do your best, and try to plan a career that would give you a shot at becoming an astronaut. If you don't make it, you are still doing something satisfying for you.

**You were part of a period of incredible adventure and possibility. Was it also political?**

It is easy to see that Apollo was a political decision — in the beginning. Once I got selected, we didn't really think about that too much. The focus was on getting the job we wanted to do done, to land on the moon by end of 1969. That is the focus I remember. The political context quickly changed to the scientific one, and morphed into a tremendous scientific programme for the world.

**The world first heard your voice speaking to Neil Armstrong on Apollo 11, saying, "You got a bunch of guys about to turn blue." What are your recollections?**

I remember dead silence in Mission Control, which was extremely rare. Look at the old footage; during the final minutes, you can see the tension on our faces. It was a great relief when Buzz [Aldrin] said, "Contact light, engine stop." It meant they were

on the ground and in good shape. But it seemed to me an eternity before Neil said, "Houston, Tranquillity base here, the Eagle has landed." It was like a balloon popping in Mission Control. I was so excited, I couldn't even pronounce "tranquillity".

**You were back-up crew on Apollo 13. Where were you when things went wrong?**

When I first got there it was about a half-hour after the accident. The first focus was to get them back on a free return, with the lunar module powered up. Then, would we have enough stuff to make it? When we had at least got them headed home, there was a little relief. But we looked at the consumables; everything was running out. Twenty hours before landing, I thought, we ain't going to make it. But we got smarter. Nobody gave up.

**For your own mission, you had a clear sense of these dangers. Was it a fearful situation?**

It really wasn't. We had faith; the Saturn had never failed us. The only time in the mission I had fear was when we had the Moon Olympics — setting high jump records. I gave a big jump and fell over backwards. That was scary. Fortunately I broke my fall when I hit my back. Mission Control was very upset. That was the end of the Moon Olympics.

**Still, you got the record for the high jump. Looking at the footage, you looked like you were having fun.**

We did. We decided we were going to have fun. To do our job, to get everything accomplished, but to enjoy ourselves while doing it. I'm glad it came across, because that is the way we felt. Enjoy this beautiful, exciting adventure.

## SPACE IN THE MEDIA

Whether in film, on TV or being crooned about in songs, space exploration has been the subject of some great works of popular culture

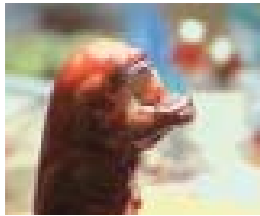
### MOON SHOT

FRENCH SILENT FILM *LA VOYAGE DANS LE LUNE* OR "A TRIP TO THE MOON", MADE IN 1902, IS THE WORLD'S FIRST SCIENCE FICTION FILM, FEATURING A GROUP OF EXPLORERS WHO TRAVEL TO THE MOON. IT IS DIRECTOR AND MAGICIAN GEORGES MELIÉ'S 400TH FILM



### SPACE SCARES

"IN SPACE, NO ONE CAN HEAR YOU SCREAM," READS THE TAGLINE FOR SIR RIDLEY SCOTT'S DEEP SPACE FRIGHTFEST, *ALIEN*. THAT INFAMOUS SCENE WHERE AN ALIEN BURSTS GORILLY OUT OF A CREW MEMBER'S CHEST? THE DIRECTOR HADN'T TOLD ANYONE ELSE IN THE SCENE THAT WOULD HAPPEN



### CHEESY TUNES, CHEESY PLANET

"WHEN THE MOON HITS YOUR EYE LIKE A BIG PIZZA PIE, THAT'S AMORE," CROONS DEAN MARTIN IN HIS SIGNATURE SONG, "THAT'S AMORE", A CHEERY NEAPOLITAN-STYLE TUNE. IT ROCKETED UP THE MUSIC CHARTS IN 1953



### FIESTY FANBOYS

IN 1976, NASA'S PROTOTYPE SPACE SHUTTLE *ENTERPRISE* IS NAMED AFTER THE FICTIONAL STARSHIP IN THE *STAR TREK* TV SHOW. DUE TO A HUGE CAMPAIGN OF TREKKIES WRITING IN TO THE AMERICAN PRESIDENT



### ASTRO-ROCK

ZIGGY STARDUST, DAVID BOWIE'S STAR PERSONA, RELEASES THE TRACK "SPACE ODDITY" IN TIME TO COINCIDE WITH THE LAUNCH OF APOLLO 11 IN 1969. ITS SPACEY LYRICS TELL THE STORY OF A DOOMED ASTRONAUT: "AND I THINK MY SPACESHIP KNOWS WHICH WAY TO GO, TELL MY WIFE I LOVE HER VERY MUCH, SHE KNOWS"

### LIKE FATHER...

THIRTY YEARS LATER, DUNCAN JONES DIRECTS AN EDGY, DOOMED-ASTRONAUT-IN-SPACE THRILLER CALLED *MOON* — NO POINTS FOR DEDUCING WHERE THE SCENE IS SET. THE DIRECTOR'S FATHER? DAVID BOWIE



juice would come out and start flying around his helmet. If his movements look odd, it may be because he is trying to catch a drop in his mouth. "It was very frustrating. It would hit my nose and start crawling up my head."

Listening to the transcripts of Apollo 12 mission, one is struck by the flood of Pete Conrad's country and western music. They flew to the moon on a diet of "San Antonio Rose" and "Louisiana Man". When they got there and opened their checklist, they found a back-up

Buzz Aldrin suffered clinical depression and alcoholism after his return, but beat them both; Armstrong largely retreated from public life. Edgar Mitchell found belief in the paranormal and faith healing; while Harrison Schmitt became a Republican senator in New Mexico, and something of a sceptic about climate change.

For Duke, after a shift into corporate life, he found meaning in religion. "I found peace and a purpose through my faith," he says. Bean found perhaps the

## WHEN DCM CALLS, BEAN IS PAINTING ARMSTRONG AND ALDRIN'S LUNAR MODULE, THE EAGLE, FLYING OVER A CRATER LOOKING FOR ITS LANDING SITE

crew had added a picture of a naked woman, with the note: "See any interesting hills or valleys?" Even in space, there was room for levity, to laugh and let off steam.

Still, acknowledgement of potential danger is essential. Mullane wrote that during his training, astronaut candidates were played the tape recording of Gus Grissom, Ed White and Roger Chaffee as they burned to death in the testing of Apollo 1 in 1967, just to remind them what they were getting into. Fatefully, many members of Mullane's class died on the Challenger in 1986.

There are sacrifices too. Separation from family is taxing, and not just on the astronauts. When Duke wrote his autobiography, he did so in partnership with his wife, who wrote openly and movingly about how the depression she felt in being neglected during Duke's career almost led her to suicide.

### SO NOW WHAT?

For the Apollo moonwalker astronauts in particular, another question is just how you find meaning in your life after having done something so extraordinary. "After Apollo, I was standing on top of the mountain," Duke says. "There was nowhere else to go." It is fascinating to see the paths the moonwalkers' lives took.

most distinctive next phase of all: he has spent the later years of his life painting images from the Apollo missions, using small amounts of moon-dust from his mission patches, and applying texture with a bronze cast of his moonboot and the hammer he used for tests while on the moon.

"When I am dead and gone, these paintings will remain and tell stories that would be lost any other way," he says. When *DCM* phones him, he is painting Armstrong and Aldrin's lunar module, the Eagle, flying over a crater looking for its landing site. In case you are now reluctant to try for space, consider Duke's response when we asked him to cast his mind back to the moon's Descartes Highlands and describe the image that stayed with him.

"On our second EVA, we drove the rover to the south and up the side of Stone Mountain," he says after a moment of thought. "When we got up [about 60 to 90 metres] off the valley floor, we turned the rover around on a little bench on the hill and looked across the valley of the Cayley Plains. There was a distinct gap between the lunar surface and the blackness of space, with the lunar module sitting in the middle of the valley. It was a very dramatic sight — the beauty of the moon."

Such memories are why people still dream of being astronauts. ●

CHARLIE DUKE REVIEWS THE FLIGHT PLAN AS THE SPACESUIT PRESSURE CHECKS ARE CONDUCTED BEFORE LAUNCH



Have A Nice Day

### DR JEFF FORSHAW, PHYSICS PROFESSOR AT THE UNIVERSITY OF MANCHESTER, ON SPACE PROGRAMMES:

In the very long term we surely have to explore the universe at large. We have to leave the solar system and explore it. You can argue that now's not the time to do that, but it's a strong argument for having a space programme. It's inspirational, and of immense cultural value. People are motivated to take up science to reflect on the universe. It's worth having a space programme just to reflect that value.

PHOTOS: NASA; SMITHSONIAN'S NATIONAL AIR AND SPACE MUSEUM (1964 XRAY OF A4-H "UNIVERSAL" HELMET)





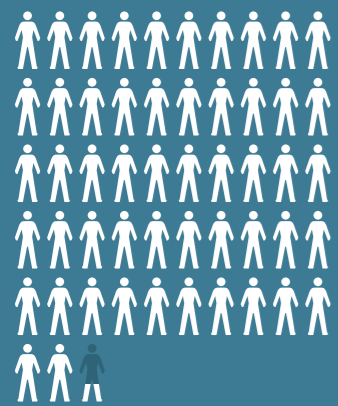
# LUNAR LOWDOWN

We may glance at the vast sky almost every night of our lives, but how much do we actually appreciate one of our nearest planetary neighbours, the moon? Sometimes it's good to be reminded how much power we need to thrust into space, how you pee on another planet, and the crazy amounts of floating junk there is in our atmosphere

ILLUSTRATION: MARK MCCORMICK



Amount of time it took from humans launching into space to walking on the moon

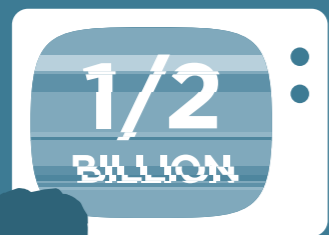


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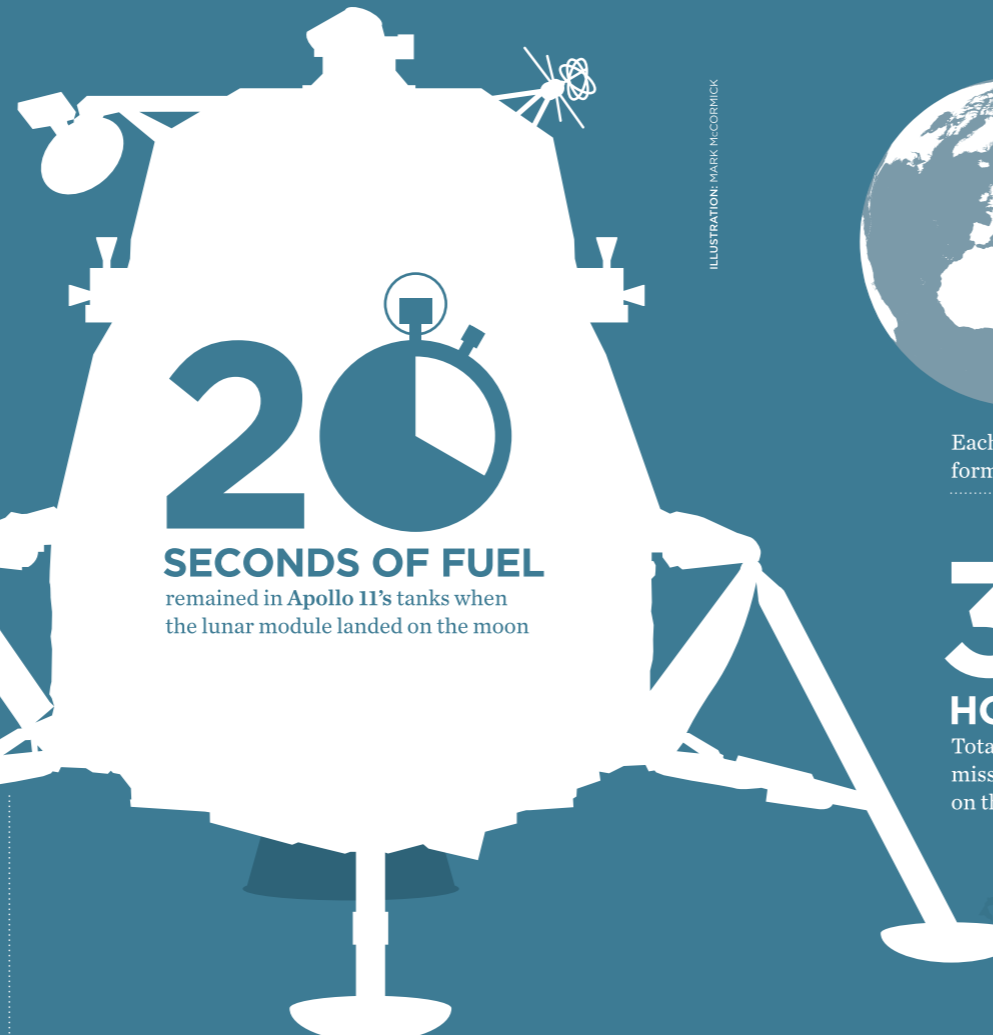
Number of men who first walked on the moon

# 523 PEOPLE FROM 38

COUNTRIES have been into space, as of June 2011

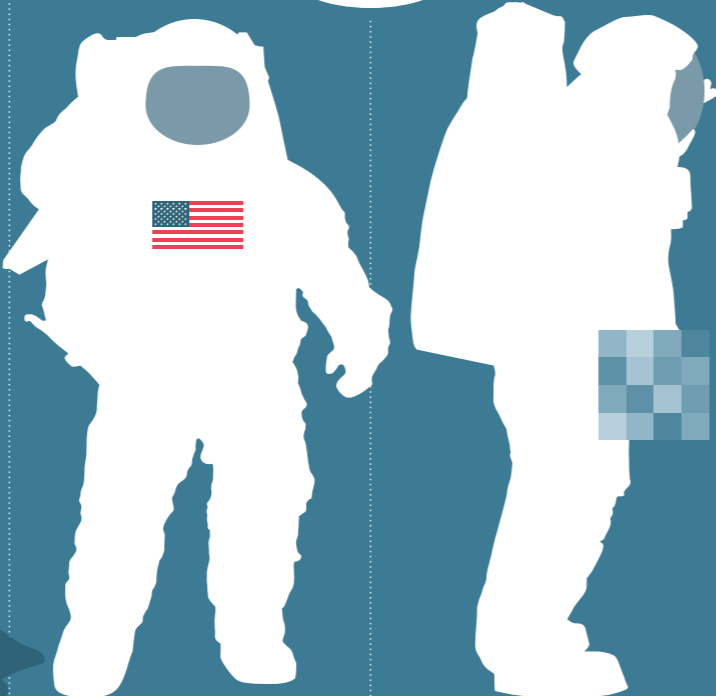


Number of people on Earth who watched the live transmission of the moon landings



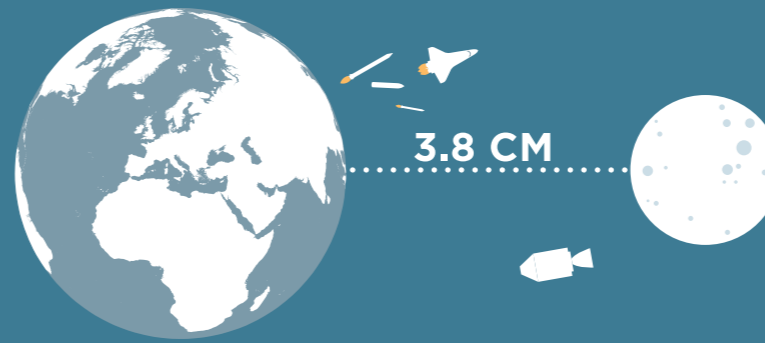
# 20

SECONDS OF FUEL remained in Apollo 11's tanks when the lunar module landed on the moon



On 21 July, 1969, Neil Armstrong was the first man to walk on the moon

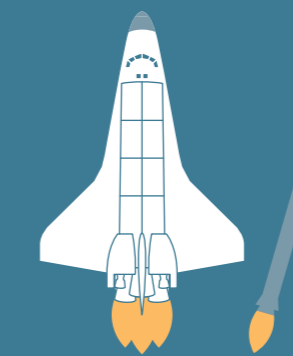
Buzz Aldrin was the first man to urinate on the moon (into a special bag in his space suit)



Each year, the moon drifts 3.8 centimetres from Earth. When it first formed, it was 22,530 kilometres away. Now? 383,000 kilometres

# 34

HOURS Total amount of time the Apollo missions spent pottering around on the moon's surface



# 1.5

MILLION Approximate amount of thrust in kilograms that each of the Space Shuttle's rocket boosters uses to launch into orbit

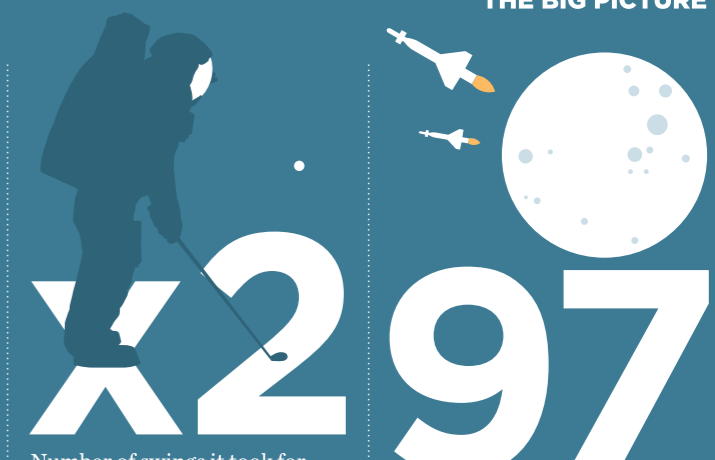


# 1963

The year Valentina Tereshkova became the first woman in space. It took 20 years more before the first American woman went into space on the space shuttle, Challenger

# 2020

The year Chinese astronauts will walk on the moon, according to Chinese officials



Number of swings it took for Apollo 14 astronaut Alan Shepherd to connect with the golf ball for his infamous moon shot



# 80

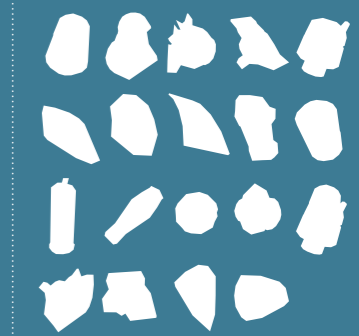
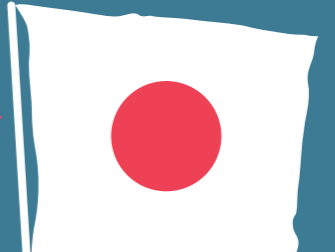
Number of times windows have had to be replaced on the Space Shuttle due to space debris impacts, as of the year 2001

# 437

DAYS Number of days Russian cosmonaut Valeri Polyakov spent in space, the longest-ever amount of time by a human

# 2024

The year Japan hopes to initiate a manned mission to the moon



# 19

THOUSAND Number of known space debris larger than 10 centimetres

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# TO OUTER SPACE AND BEYOND



There are some truly impressive job titles out there. Being a father of molecular gastronomy (page 52), or architect of RenderMan (page 60) is difficult to beat. Unless you're a real-live astronaut — surely the epitome of a cool job.

Mankind still has a childlike fascination with space. The recent successful return of Japan's long-term mission from the International Space Station, broadcast live by Discovery Channel HV Japan on November 22, 2011, is another reminder to us of just how universal our excitement over space flight really is — and how like never before, the opportunity to venture beyond our atmosphere has really become a global one.

So what would it take to make it onto one of those missions? We take a detailed look at how to get there, and what the experience before, during and after, is actually like (page 36). For me, reading the personal accounts of two of the 12 people to set foot on the moon was a joy. And if our writer Chris Wright is anything to go by, it was a thrill to compile too. He even sent me a note, admitting that aside from three lengthy interviews, he had gone slightly overboard researching our space extravaganza: "I reeeeeeeally over-researched this; read four books, watched three DVDs... total information overload. Fun though!"

Going overboard is a big part of *Discovery Channel Magazine*. For our second banner feature, on animation (page 60), I spent many pleasurable hours interviewing practitioners in the film animation field, whose jobs have seen their work appear in films like *Kung Fu Panda*, *Toy Story*, *The Matrix*, *Terminator 2* and *Avatar*. It was another long study in pleasant obsession — which is an apt description of an industry in which it often takes up to five years to complete each movie.

We explore other obsessions, including the revolutionary world's fondness for the AK-47 (page 74), a weapon which, while iconic in its design, is not actually the most accurate of shooters. Less fierce but no less frenzied is our exploration of the weird and wonderful universe of Japan's *otaku* (page 86), a colourful subculture in which fandom becomes a way of, even an expression of, life.

And speaking of expression, you might be wondering what the image on the right is. It's not the International Space Station, but you're close. It is an artist's impression, courtesy of NASA, of the Space Station Freedom. The 1991 painting shows what could have been a permanently crewed orbiting base, an attempt at international cooperation which was to be funded by a dozen countries and completed in the 1990s. It never came to fruition, but is a pleasant reminder that where space, science and art is concerned, we love to dream big. So here's wishing you a New Year filled with pleasant and prosperous obsessions — filled with dreaming big, and delivering even bigger.

