

Hi this is Steve Nerlich from Cheap Astronomy [www.cheapastro.com](http://www.cheapastro.com) and this is *Apollo 11 – Getting there*.

This is the first of three podcasts on the Apollo 11 mission which launched on the 16th July 1969.

Apollo 11 was the culmination of eight years of intense space activity by both the Americans and the Russians. The Americans had begun with the Mercury program from 1961 to 1963, involving six launches of solo astronauts, developing skills in launch, ground control and Earth orbit manoeuvres. Then the Gemini program launched two man crews in ten missions from 1965 to 1966, developing skills in long duration flying, space walking and vehicle rendezvous.

Then the Apollo program flew three men crews, testing a command module in Earth orbit with Apollo 7, flying it to the Moon with Apollo 8, testing the lunar module in Earth orbit with Apollo 9 and then flying it to the Moon in Apollo 10 – which had launched two months previously in May 1969.

So, on the morning of the 16<sup>th</sup> of July, the Apollo 11 crew are all strapped in and ready to go. From the left is Mission Commander, Neil Armstrong the second ever civilian commander of a space mission crew, the first having been – well, Neil Armstrong, on Gemini 8.

He had been drafted in 1948 for the Korean War, became a naval aviator, flying 78 missions – but after the war he resigned his commission. Armstrong was 38 when Apollo 11 launched – his second ever space mission after Gemini 8.

Next, in the middle seat of the Apollo 11 command module is Lunar Module Pilot Colonel Edwin Buzz Aldrin. Buzz was apparently a childhood nickname, owing to his sister mispronouncing the word Brother as Buzzer. In fact Aldrin had his name officially changed to Buzz in 1988 so the Edwin is kind of redundant now anyway.

Aldrin was 39 when Apollo 11 launched – his 2nd ever space mission after Gemini 12, when he had become the first person with a PhD to fly in space. On Gemini 12, Aldrin conducted the most successful of the Gemini program's spacewalks, having first acclimatised himself by training in a space suit underwater – an approach still commonly used today.

Aldrin is the astronaut in the iconic man on the moon photo - he is also a You Tube celebrity with footage of him punching Bart Sibrel, a moon hoax nutter, who confronted Aldrin outside a hotel, with a camera set up to film the incident, and called him 'a coward, a liar and a thief'. The police declined to file charges, viewing that Aldrin had been unreasonably provoked.

In the right hand seat is Command Module Pilot Lieutenant Michael Collins – although now (ahem) Major-General Collins. Collins is the one everyone forgets in trivia quizzes. Being the pilot of the command module means you're the one who has to stay in lunar orbit while the other two land in the lunar module. He was 38 when Apollo 11 launched – his 2nd ever space mission after Gemini 10. Collins move into the Apollo program was complicated by a cervical disk herniation which required surgery in 1968 – forcing him to miss the Apollo 8 mission he had been scheduled on – his place taken by Jim Lovell. So Michael Collins was

rescheduled to Apollo 11, while Jim Lovell, on his next rotation, got Apollo 13 – so a mixed blessing there perhaps.

Collins was also a particularly keen autobiographer. While many astronauts have published their experiences – and Collins' *Liftoff* is a nice example – Collins also wrote *Flying to the Moon* – for a children / younger adult audience.

The Apollo 11 crew was the second ever crew to fly with no rookie astronauts – the first having been Apollo 10 – and the next would not be until the Space Shuttle mission STS 26, the 'return to flight' mission after the Challenger disaster in 1986. So a no-rookie crew gives some indication of the high risk status of the Apollo 11 mission.

Anyway, back to the 16<sup>th</sup> of July, 1969. By 1pm Greenwich Mean Time (or 9am local time) tensions were high as there was a fairly tight launch window, since NASA wanted the landing to take place just as the Sun was rising on the Moon over the preferred landing site (called Apollo Landing Site – or ALS 2) in the Sea of Tranquillity. So Apollo 11 would need to launch in the next five hours or risk a different landing site.

The mission parameters required the Sun to be just rising at 5 to 14 degrees in the Moon's sky (where 90 degrees is straight up) to ensure there were long shadows on the ground to help identify rocks and craters. Also, the lunar module would come in at a 16 degree angle – and data gathered by Apollo 10, which overflew ALS 2, indicated that if the Sun got to 18 degrees sunlight would start to reflect straight back into the eyes of the astronauts – and if the Sun got any higher than that, there would be no long shadows.

But despite distant thunderstorms, Apollo 11 did launch at 1.32 pm. The first stage of the Saturn V fired for 2 minutes 42 seconds to gain an altitude of 70 kilometres and a speed of about 10,000 kilometres an hour. The first stage then dropped away and the second stage fired for another 6 minutes and 26 seconds, gaining an altitude of over 180 kilometres. Up to 100 kilometres of altitude Armstrong had had one hand on the abort handle, which if pulled would fire the little launch escape rocket which would blast the command module and its crew away from a potentially highly-explosive Saturn V.

But with the Saturn V performing faultlessly, the escape rocket was jettisoned along with a protective cover over the command module – allowing the astronauts to see out the window for the first time and watch a blue sky turn to black.

The third and final stage of the Saturn V fires twice, the first burn to fly the spacecraft 'down range' – meaning its trajectory increasingly arcs over towards the shape of an orbit. After this first two minute burn, the spacecraft was just over 190 km in altitude but over 2,600 kilometres 'downrange', from Kennedy Space Centre in Florida – and coasted into a stable Earth orbit 11 minutes and 49 seconds after liftoff, maintaining a speed of 7.7 kilometres a second (or 2,800 kilometres an hour).

In orbit, with no rockets firing, the crew experience weightlessness for the first time in a heads-down orientation so they are looking up at the Pacific Ocean. For the next two and a half hours, the crew undertook a thorough systems check, while their spacecraft completed

one and a half Earth orbits. Then, as they were passing over Australia, Mission Control sent the message “Apollo 11, this is Houston, you are go for TLI”.

TLI, meaning translunar injection, is where the still attached third stage of the Saturn V fires for the second time, for nearly six minutes, increasing the spacecraft’s speed to 10.8 kilometres a second – which is essentially an escape velocity from low Earth orbit. So, just two hours and fifty minutes since liftoff, the crew were on their way to the Moon – on a trajectory that coincided with a point in space where the Moon would be in about three days time.

And if you are keen to see how all this works out – tune in for the next episode.

Thanks for listening. This is Steve Nerlich from Cheap Astronomy, [www.cheapastro.com](http://www.cheapastro.com). Cheap Astronomy offers an educational website where expenditure is not an option. No ads, no profit, just good science. Bye.