A Conversation With Buzz Aldrin

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Colonel Buzz Aldrin

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Interviewed onstage by

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Dr. McCurdy: I thought I'd start off by asking just a few questions about Project Apollo; this amazing phenomenon that interest in the mission seems to grow with time. Buzz gave a speech recently; I want to quote from. He said, "Apollo 11 is a symbol of what a great nation and what a great people can do if they work hard, work together and have strong leaders with vision and determination." **(To Colonel Aldrin:)** – Is this reason that Project Apollo lives on in the national consciousness beyond the accomplishments of going to the moon? Is it what it represents and what a nation can do?"

Buzz Aldrin: It came at a very crucial time. The Cold War was kind of moving on; we're getting to realize what it meant. The Soviets caught up with us, surprisingly, with the hydrogen bomb and it was beginning to just look a little bit discouraging. We were beginning to approach this mutual assured destruction where each nation has a weapon pointed at them to try to convince the other one that it would be unwise to start because they would be assaulted with a massive destruction in retaliation. Not a very peaceful way and there was an international geo-physical year in 1957 and 1958 and the nations got together and there were mentioned that there might be the opportunity for the United States but also Russia to put up an artificial satellite.

Well, they surprised us – enormously with Sputnik and we responded in a progressive and determined way. But they photographed the backside of the moon and put a dog up. So, all the craters on the back side of the moon are named after Soviet or Russian icons from the past.

It took a response from a very strong leader and that response was similar to the response after Pearl Harbor – that this nation just came together. It came together during a difficult time also of conflict in Southeast Asia. I had been involved in the Korean conflict and it just looked like that was another expansionist movement. We were determined to do the best we could to stop that. I think we had a bold response and a lot of people just didn't believe it.

John Glenn, I think, mentioned that in the week after Yuri Gagarin, on April 12, made one orbit of the earth. Then, less than a month later, the best we could do was Alan Shepard and the suborbital flight for only 15 minutes because our big Atlas rockets weren't ready to go. In a lead-up to the opportunity the President did exercise on May 25th, about a week before that, some of the astronauts were asked to come in – the Mercury people – and they were explaining that the President said, "Do you think we could go to the moon?" and they all said, "Yes, sir. Yes, sir." And as they walked out, one of them said to the other, "Is he nuts?"

There was a lot of skepticism, even among the people who might be called to carry that out. But we did it despite setbacks with the Apollo fire, and I think that whole spirit of progression in a very positive direction excited young people. We started with the Mercury program of one person. The Russians were still ahead of us in what they were doing. We had an Apollo program with three people – rather complex – but we had the wisdom to not bring those two together; to put in a new program in between with two people. That very progressive step-by-step approach contributed so much to be able to get into the Apollo program.

Since that time, of course, the big "never been done before" even after we went to the moon twice with Apollo 8; without a lander tested; the lander in Earth orbit, and then took the lander to the moon in a complete test rehearsal. Neil and I had been on the backup crew for Apollo 8, so shortly after that we were put on the crew. Nine and 10 had not flown yet, but the confidence that existed indicated that our crew could be the first to land on the moon, and we just assumed that the next two would have success. And they did, miraculously. So we were given the mission of landing on the moon.

Those were indeed positive, miraculous (moments). And at each five-year interval there's a bit of a reunion. At twenty years there was a bit of excitement. The President and the crew stood on the steps of the Smithsonian, and the President said in 1989 (that) we're going to finish this space

station, then we're going to go to the moon – this time to stay. And then expeditions to Mars. That didn't get past the opposition in Congress; they were out to prove that he was extravagant. The President had only been in office six months from January 20th, my birthday, to July 20th of 1989 – the 20th anniversary when he said we're going to go to the moon.

So, there was a bit of a down time after that. But I think there is an awareness of some of the things that we're trying to do. We've seen the shuttle fly since 1981 and the space station was approved in 1984, I believe. It's supposed to be ready in eight years – $8 billion for eight people. Well, we just barely got six people up there last month and that's a little bit later. It's cost an awful lot of money and those things have not really inspired people all that much. Great technical achievements – the space station is an enormous facility and it promises to be a very beneficial laboratory, but it has just not lived up to expectations. And with the Colombia accident it now appears that we need to move on.

Just before the Colombia accident in 2003, the first of February, NASA was saying, "We're going to fly the shuttle until 2020 or 2025." Not anymore. After we lost Colombia, this was the turning point that charted a new course. I lived in Montclair, New Jersey. When I moved out, Yogi Berra moved in. We were both inducted into the New Jersey Hall of Fame. Now, Yogi says, "It isn't over 'til its over," and I've been quite aware my whole career that once you're a celebrity, you remain one. But when there's a fork in the road, take it.

Well, we took it and I believe that we shouldn't go back to the fork in the road and stay in low earth orbit. I don't think we took the right fork, but we learned by doing it for forty years. We can cross over to another (path) and let someone else continue on that pathway to go to the moon. I'm getting ahead of myself.

Dr. McCurdy: The moon program right now is in trouble – it doesn't have enough money to get to the moon by the deadline, which is 2020. The Chinese have said they want to go by 2020. You did a space race in the 1960s that excited our interests. Should we have a space race in this decade or the upcoming decade with the Chinese?

Buzz Aldrin: No, I really don't think that a race is productive. We won the race in 1969 and for us to do it again to be second when someone else is trying to be first doesn't make any sense at

all. You can compete maybe at the lower level to see what you can do but it is good to cooperate in the execution. Now as far as China goes, I really think we could advise them to be a part of the space station. They wanted to be, but for various security reasons we've decided against it and that's just going to get us further and further apart.

I do not want to see a Cold War in the 21st century and I'm afraid that by allowing terrestrial discords; human rights; piracy; secrecy – those things could get at us. There's going to be a lot of conflict in the next war up in space. You can be assured of that because of the assets in satellites that we have; that they have. We have more to lose up there than they do. I really believe, and this is another one of my agendas, that there's a security redefinition at the borderline in space – one hundred kilometers up. Anything that goes up, or comes down, should be registered, and there should be a sunset clause or an end-of-mission where you put something up there and you are responsible to bring it back down again.

Now, everybody has a concern about that. The Chinese certainly do. We do. And we launch assets – satellites for other countries, and they're concerned about it – everybody is. Debris is the problem. If you look at it carefully, there are two kinds of debris – accidental and intentional. You know what? Intentional debris is created by anybody. We need to come together to redefine things that, in 1967 with the Outer Space Treaty were just not imagined.

Dr. McCurdy: You've referred to the moon as a global commons.

Buzz Aldrin: Yes. It's wonderful – "commons." That's a term that the governor of Alaska – Wally Hickel – used. Governor Hickel wrote a lot of stories about the common ownership of the resources. What I mean by the moon being a commons is it's been explored by us; by the Russians. And then we sort of left it alone for awhile and everyone concentrated on other places. But now we're back to looking at possible places to land. The Japanese have a wonderful camera in orbit and the Indians have a satellite up there that's much admired. The Chinese have talked about wanting to go. So there's more enthusiasm I guess because we decided in January 2004 that we were going to set a new program, a vision for space exploration, and we would finish the space station as soon as possible, retire the Orbiter in 2010, build a new spacecraft and get to the moon by 2020. Well, this excited more and more people to start thinking about the moon.

When you explore something, the next step is to develop it. Now other nations are going to explore the moon and we can work with them. We have resources. We've put $100 billion into the space station. To put $200-$300 billion into the moon when we've already been there and there is not a really definitive product to be developed that can begin to pay for habitation – habitation on the moon is just going to be very expensive unless it has a purpose.

Robots can go there. Robots can deploy most of the scientific experiments. But we're kind of lucky because other people are going to go there and if we help them then they may help us. We'll work together with their manpower; their resources to fix the robot that gets broken or to augment things. Internationally there's a word for it: "International Lunar Economic Development Authority." There's ITSEC, the International Telecommunications, and COMSEC. These are combination commercial and government entities (that) end up being run by the private sector eventually.

Dr. McCurdy: Now, if we're to move beyond the moon, I'm assuming that we're looking out towards Mars, which has always been a long-term decision. That's going to be very hard and very expensive to get to. You proposed some interim steps.

Buzz Aldrin: There are places beyond the moon – near-Earth objects. I propose that we catch up with them or they catch up with us. There are comets out there and the next planet out is Mars. Mars has two moons. The inner moon goes around in seven hours. The outer moon, Deimos, goes around in 30 hours, but the inner moon, Phobos, is the one that I think is so strategic. From Kitty Hawk in 1903 to Tranquility Base landing on the moon was 66 years – that's tremendous progress. Just look at what has happened during those 66 years. Now, let's add another 66 years to 1969 and we get 2035. Certainly, we can go from putting Americans on the moon to putting Americans on Mars in 66 years, I think. We have a little catching up to do with the rate of progress. Or people are going to catch up with us.

There are comets. There are near-Earth objects – asteroids. What we really need is an exploration module, XM, that can give us life-support for a year or two at different locations. We have a spacecraft that looks like Apollo that can go up and come back down again. That is under design right now and testing. That's good. Some of the rockets, I think, are destined for the moon and there are lots of little problems with those. We can save some money by moving in different

directions with the launch vehicle and the lander. What we do is put up one of our XMs and eventually there's a refueling station. The next one goes up in cycles back and forth between the Earth and Mars; Earth and the moon, and then becomes a communications relay. The other one becomes a fuel depot in the vicinity of the moon for us to use to go beyond the moon and for other people to use to go to and from the moon. This would be a commercial activity – people bring up fuel to the refueling place, somebody pays for the fuel they bring up and somebody goes and buys it, the government buys it to do what they're going to do and all these things are worked out ahead of time.

There is a time in November; late November 2018, when we could fly by a comet. Can you imagine all the young people with binoculars watching the tail of that comet; looking at their TV sets out the window of the spacecraft and seeing the comet approaching? We fire a little penetrator. It causes the comet to burp. Everyone down here sees that. These are exciting things for young people to know.

We (could be) doing something progressive every year or so and eventually we're able to put the next unmanned (rocket) up here at Phobos. That's around 2023. Then we could put a crew up there for a year-and-a-half, bring them back, send another crew up, bring them back and then a third crew up there. Now we're in 2029-2030 and this is the crew that comes from the Earth and lands on Mars, but it's preceded by the crew that's (already) up there. Those are just details that, to me in my experience, make sense as we put together a progressive program while the internationals are doing the moon with us and we have the space station that continues to stay up there. These are human missions.

There are all sorts of other satellites and other things going on. It's going to be a very busy time and I think we deserve to have U.S. global space leadership going outward. This takes a little more than two decades but we have things happening all the time. We stopped landing on the moon in 1972. One decade was '82, the next was '92, the next, '02. Not much was happening. Let's do something during two decades that's very progressive and very exciting and very challenging, and not break the bank, especially in the early parts.

Dr. McCurdy: What do you say to people who say, "This is all very nice, but it's too hard; it's too expensive?" I was thinking about what (people) were saying in 1961; the same (comments)

about the moon. Let's think of some of the technology challenges that we had at that time. We didn't have the rocket that could reach the moon. Maybe you can talk about the lunar orbit rendezvous. There were huge technology challenges in 1961, and eight years later we were there.

Buzz Aldrin: Well, the important thing that happened between Sputnik and the moon was that it was continuous progression of activities. We had that one-man spacecraft, the three-man Apollo and the fill-in-the-gap with the Gemini. When the President said we're going to go to the moon, there was a giant rocket called Nova and von Braum's dreams – a little bit on paper, but that wouldn't have been ready in time.

Two Saturn 5s were the next choice, but then a wise engineer said, "Wait a minute. Instead of two big Saturn 5s joining together in Earth orbit, why don't you send two spacecraft to the moon? When you get there one will land and the other will stay there." To get back again, the one comes up and rejoins this one and then this one comes home and we throw away the other and you could do that with one Saturn V. He's my role model because he saw the system and he came up with a better way of doing things. That's what made a big difference and helped us win that race.

We made the flexibility to look over choices. With Apollo, we had a gap of almost six years and we didn't have flexibility then in our choices. It gets a little complicated to explain, but we have a gap of five or six years where the world has to buy rides to our space station from the Russians. It looks like the days of landing on the runway – 30 years' worth from 1981 when we started the shuttle – they're liable to be over. We're going to be landing in the ocean for the next 20 years unless we change the direction of U.S.-global phase leadership and design a mini shuttle.

Dr. McCurdy: Let me ask some of the audience's questions at this time. Gary Moore says. "do you think that this new service fleet crew module would be capable of servicing the web's observatory or engaging asteroids deflection?"

Buzz Aldrin: The new observatories are going to be at a location called "Sun, Earth 2." If we bring an exploration module, it will come back, swing by the earth, the crew will get off and then we can leave it where it can be useful for the next major telescope. The exploration module that I have a group looking at is essentially taken from two landers that are designed to land on Mars. One of them is long duration and the other one has a crew in it but they join together.

Now, we take all of those heat shields, chutes and fuel to land; the landing gear, and it's an exploration module we can land with one and habitat with another. So, we're using things that we're going to eventually use at Mars but we're backing up to use them to support a crew with the re-entry modules and the exploration module in between, too. We're going to use that to fly by the comet and just do all these things; these common spacecraft that nobody has even thought about designing, but it's a multi-purpose exploration module.

Dr. McCurdy: Here's another question: "When do you expect commercial flights into space to begin?" I presume we're talking about human flight.

Buzz Aldrin: I'm not real optimistic of sub-orbital flights like Alan Shepard's and Gus Grissom's. The successes of the X-Prize and Richard Branson are the most public effort to try to lead that, and he may be testing more of this near 2010 and '11, maybe. I'm trying to put in a lottery system in 2011 or '12. Some other people may possibly beat him but it's going to take a good while and let me just tell you that just going up and down is so much different. He just goes over the top and not even high enough to stay in orbit at 100 miles an hour or less.

You have to be going 17,000 miles an hour – that's a lot of speed, isn't it Dennis [Tito]? Dennis has been at 17,000 mph with the Russian Soyuz spacecraft and that takes tremendous amounts of energy. So you're not going to have tourists going up and down and then five years later going into orbit. The kinds of spacecraft that can do that are what should follow the shuttle: something that lands on the runway and can be evolved into less expensive rockets; hybrid rockets.

A company, SpaceX-ElonMusk, is developing what (may be) a much cheaper rocket than some that we have today. That may happen; that may not. It is just very expensive to take a person into orbit. But it will happen, and I think maybe a lottery system where guaranteed prizes are suborbital, but not guaranteed prizes may be orbital prizes –that's what I have in my mind. Maybe a new way so you don't have to come up with $15, $20, $25 million to fly into orbit.

Dr. McCurdy: We have commercial firms going to the edge of space without the Chinese and who-knows-what other countries going to the moon with our help. We're on our way to Mars…

Buzz Aldrin: It can be very exciting, but if we go back to the fork in the road (wherein) the only thing we do is stay in lower orbit so we can verify global warming; I think we can do more than that. I think we can do more than increase our science education by 2020; much more. We need to inspire young people to want to learn science. We do that by doing the exciting things in space – that's what happened in the '60s and '70s and that can happen again.

Dr. McCurdy (reading another audience question): "Thank you for your heroism. What critical technological hurdle stands in the way of the USA-Mars expedition?" I should preface this by saying that Buzz wrote his PhD dissertation in 1963 on orbital rendezvous. That was after the moon decision but before we'd ever done it. Then he went up and did it himself.

Buzz Aldrin: It was really kind of a backed-up system so the pilot would understand what was happening. If something went wrong with the primary system we could have a system alternate simple measurements. If you have enough computers it's tedious, but guess whose flight had a radar malfunction so the computer couldn't come up with the right solution? We had things covered wonderfully on Gemini 12. I was able to do some space walking with success because I was a scuba diver and learned that you can train under water and you need foot restraints – you walk around on two feet and you have to have the other restrain your feet somewhere unless you're sitting down, and you can't get as much done if you're sitting as when you're standing.

Dr. McCurdy: Orbital rendezvous was a huge technological hurdle to get to the moon…

Buzz Aldrin: There were some impediments. One of the big impediments was long-term exposure to radiation from solar flairs and the sun, or just background cosmic radiation. We need to know more about this. We do know that it has very serious affects on the human body; the neurons in the brain, perhaps producing cancer. We need protection, and talk about coincidence – I was flying from Chicago into L.A. today and went up to shake hands with the pilot. The first officer who was a lady who lived in Clear Lake, Texas whose husband works for Wiley, a pharmaceutical company. His expertise is space radiation. So, I'm going to be talking to him and many other people who have good ideas, and we have to assemble these.

The other impediment is long-term floating in space. The muscles get very lazy. Your bones are not stretched and there is calcium loss. So we have to stress things. One way is to have, instead of

just one spacecraft compact, separate them hundreds of feet apart and then split them up. I used to think that we may have to do that but then down at UC Irvine a couple of years ago I was exposed to a very clever devise that can fit within a fairly large radius and one guy at one end pedals the bicycle and that causes it to spin around and another guy on the other end lifts weights against the centrifugal force and stresses other actions. But there is a little bit of problem that when you get something going around this way the rest of the spacecraft may want to go the other way. But we're engineers. We can figure things out.

Dr. McCurdy: A couple of personal questions coming up. This from a Dr. who asks, "How high was your heart rate when you were landing on the moon?" Or were you paying attention to that?

Buzz Aldrin: I certainly don't know, but we have somebody in the control room in Houston who's monitoring our heart rate all the time. I think Neil's was a little bit higher because it was his responsibility to get the thing on the ground. Mine, as first officer co-pilot, was feeding him as much information as I possibly could, so I was reading off the numbers in the computer of altitude, altitude rate and velocity over the ground. That gave him numbers that made sense of what he was seeing out the window, and then he could plan knowing the altitude and the speed to slow things down. The computer was going to do that anyway. But it takes a team to do things like that and we're going to have great teams working in the future.

Dr. McCurdy: Can I tell them what the risk was? The astronauts never like to talk about this. They all say, "Well, that's just not true." Risk analysts looked at the odds of a successful first landing on the moon and said 60% – that meant a 40% chance that it wasn't going to happen. Now, that doesn't mean they weren't going to come back – that was a different probability. But there was a 40% chance that you weren't going to be able to land.

Jim Wilson wrote, "What were your thoughts when you heard the '1201' alarm that meant basically that the computer was not working.

Buzz Aldrin: Well, we knew we didn't have the answer. The answer was in a thick book that was stored away over a year ago. We were kind of busy making the landing. We looked at the alarm, which blanks out the display of our information when it gives us an alarm. Sometimes it's best not to just assume that it's okay and hit the "proceed" button, so we quickly asked Houston to

give us a clearance on that. Fortunately some people had gone through exercises that were similar and they came back and said that we're clear to go on that particular alarm. It didn't come up more frequently than about once every minute; half a minute.

The first indication of this – the computer goes around and cycles around several hundred different things and sends all that information to different places. Then it waits a period of time and then does it again. It does this fast, but there's a certain way that it's supposed to do that and when it goes a little slower because it could be doing extra things it will hit an alarm or a gauge and tell you that it's not quite normal. We didn't know all of that so we relied on the people back in Houston to tell us all that information.

That one passed, and we could file it away as along as the alarms weren't coming up too frequently. But when it was clear we were going to be a little long, that might mean that if we started out right and were wrong, that we've been flying longer than we should and burning up more fuel. Or maybe we just started late. But Neil found that he wanted to not land right where the computer was because there was a crater and there were a lot of rocks in it, so doing the prudent thing is to smoothly fly over that rather than go up and land short or left/right. But it takes longer to do, and consumes more fuel. So, we touched down… with 20 seconds of fuel left.

Dr. McCurdy: As a professor, I cannot resist the temptation to point out that it took him longer to explain that than it did to land on the moon. Now, a question from Brandon Barbello, age 18. He asks, "How might I become one of the next generation of lunar astronauts? It is one of my life's dreams."

Buzz Aldrin: If you want to land on the moon, maybe you should learn Chinese. I think that the selection of astronauts in the future will be based more on a jack-of-all-trades dynamic than (choosing) a test pilot to manually control the spacecraft and make precision landings or execute a docking of space crafts. These things will become more and more automatic, and if they're not working then we sort of have an alternate or we turn back and don't continue with computers that are not giving us the right answer.

I think a jack-of-all-trades – somebody who can deal with the unexpected and come up with the right combination of duct tape and chewing gum to fix whatever the problem is. But very

important, we're going to have long-duration flights. We're going to have a team, and a team has to work together, so compatibility is going to be very important. We have a medical health facility. The Russians have an institute of bio-medical problems. We just look at things differently. They look at the problems and they emphasize trying to solve the problem. I think they may be a bit ahead of us.

Right now the Russians are anticipating 500-day missions to go to Mars and they have a group of people that have been isolated together with delays in time for 120 days. Right now there is a plan – a Russian mission – with the Chinese Yinghvo satellite to go to the moon – Phobos of Mars – get a sample and bring it back. That is a very complex mission. It's probably not going to go as scheduled in October, but the French have agreed to work with the Russians on this mission and supply them with long-distance tracking and sharing in exchange for getting some of the soil samples.

This is for real. These things are happening by other nations, and we just can't just sit here and try to go back to the moon and figure out what we should do from there.

Compatibility of people on long-duration missions (is important), and it may be a considerably longer mission than most people think. If we can send six people, we build a space craft to take six people. Nobody that I know is going to build one that takes sixty people to Mars. That's just way too big. We couldn't do that, but we may need more than six people to work the resources that are there and do all the things that are necessary.

When we send people there we need to accumulate a certain number that it takes to be able to live off the land. Just about here is where I remind people that the Pilgrims on the Mayflower did not hang around Plymouth Rock waiting for the return trip. They came here to settle and to deal with the risks and sacrifices, because they wanted to become new pioneers. We're going to have pioneers of the future, but it's going to be a little bit different maybe than you think.

There are going to be pioneers that go down in history. The leader of a group here on Earth, that realizes that a pathway should be announced to bring this about – a pathway maybe in 20-30 years; a clear pathway that is announced by a leader somewhere on the surface of the earth – that person will go down in history greater than Isabella, Columbus or Kennedy.

It is a big deal to begin a settlement. If you send people to Mars and then bring them back one after another, I can guarantee you that Congress will find earmarks to spend that money on and that will be the end and the whole effort of going to Mars will be wasted. So it's an important decision, and you don't have to make it now or in the next ten years – in about ten years you can reinforce that decision; you have off ramps. But it's important to establish a clear pathway that will measure our progress, increase the commitment and decide whether we want an off ramp to asteroids or something else that maybe we've looked at.

To me, this is just exciting. I wish I could speed it up. Right now my plan is to get people to the surface of Mars in 2031, within those 66-years. But I'm going to be 101.