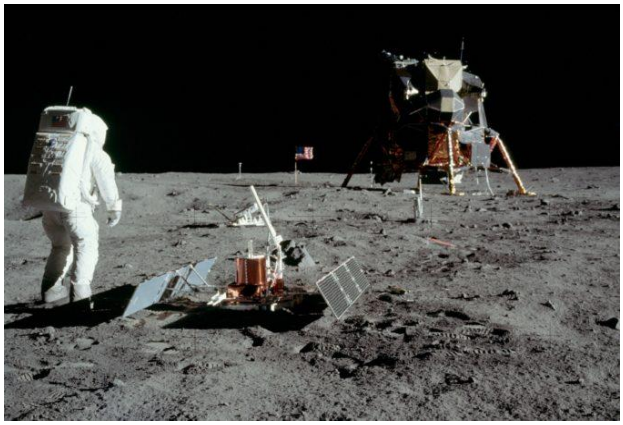


Launch Control room July 16, 1969 **Tranquility Base July 20, 1969**

Long Island Early Fliers Club, Inc.

May, June 2019 Newsletter

Editor: Fred Coste **Volume 4, Issue 3**

Editor's Note:

There was a TV show in the late 1950's called "The Man and the Challenge." As a kid growing up in what was becoming known as the "Space Age," I made sure to tune in to see all the experiments designed to measure human endurance for the emerging aerospace industry.

Facing challenges is part of life. There are many factors that will determine how we face those challenges and could depend upon our education, emotional capacity, creativity, as well as mood, level of fatigue and how much coffee one has had this morning.

For many, all of this may be accompanied by a feeling of "being alone," that moment when the world is shut out. It's simply you and your challenge. For others, a moment that bonds people who are part of the shared experience. It's also a moment that can distort time.

We are again considering the challenge of returning to the moon. Perhaps this time, to build a more permanent habitat to live there for periods of time; living off that which is abundant; colonizing a new land. It's the next step that goes well beyond the journey and a safe return home.

I recently came across a compilation of challenges faced by the Americans who had the courage to venture to our moon 50 years ago this summer. Many will argue that the effort we went to was a waste of money; how quickly they discount the value of cell phones, modern

computers, microwave communications, new construction materials, auto safety equipment, medical products and equipment, all developed from the words: "we choose to go to the moon and do the other things; not because they are easy, but because they are hard."

Though it took years of development to jump from those words to the morning of July 16, 1969 when Apollo 11 lifted off to begin the greatest human adventure of the 20th Century, let us focus on the thoughts and feelings of those involved as the challenge before them began to unfold.

This is a collection of the thoughts and memories of those who made the first moon landing possible:

Ready for Launch, Apollo 11 atop the Saturn V

JoAnn Morgan, instrumentation controller, Apollo Launch Control, Kennedy Space Center: ***The pad at night was just glorious to see with the whole vehicle bathed in these giant xenon lights. Because I got there before 3 am, it was near the very end of the propellant loading; there was a little venting of the liquid oxygen. It was just an enchanting sight to see, and I had the most positive feeling that this launch was going to be successful from the minute I parked my car and walked up to the firing room. I was monitoring everything on the pad. It's extremely intense work. When you're going through the countdown and the launch, you're very focused. Everything is preplanned--it's like a script in a play.***

Jackie Smith, spacecraft test and launch operations engineer, Kennedy Space Center: ***Launch days were always a bit out of the ordinary because you'd get up in the middle of the night and go to work. In the spacecraft world, we did not have a sequence like the launch vehicle people. We had to make sure our systems were up and functioning properly. Otherwise we had to call timeout.***

William Lucas, director of program development, Marshall Space Flight Center: ***I was very uptight. We knew that there were thousands of parts that had to work or else we'd be in real trouble. And we knew that once we gave the ignition signal there was nothing more we could do. It had to go.***

Buzz Aldrin, lunar module pilot, Apollo 11: ***I was the last one in [the spacecraft], so I was let off the elevator at a landing one stop below while [Neil Armstrong and Michael Collins] were taken up to the capsule. I was standing on the edge of this swing arm looking out at this rocket, and the [ocean] waves coming in quite a bit lower. The sun was gradually coming up, and it was really a very lonely and yet private, peaceful moment before getting into that wondrous white machine that was going to propel us off into history--we hoped.***

JoAnn Morgan: ***Astronauts Deke Slayton and Alan Shepard came in and they sat down right behind me at launch control. You knew when Deke and Alan showed up at launch control that the flight crew was ready.***

Robert Sieck, spacecraft test and launch operations engineer, Kennedy Space Center: ***Since I was the backup engineer, I was not out at the Cape. I could watch the launch with my wife and my 1-year-old daughter. The highway was absolute gridlock, and the cars and trucks weren't trying to move. Everyone was there to watch history. The vendors were sold out of everything--no more T-shirts, caps, buttons or pins. People were pulling plugs of grass from the side of the road and stuffing them in zip-lock bags as souvenirs.***

JoAnn Morgan: ***It was a wonderful countdown--I felt quite relaxed. Except when you get to the very end, the last 30 seconds, just knowing the power of the propellants on board and that those three men are sitting up there.***

William Lucas: ***The stack of the Saturn V weighed a little over 6 million pounds, so we had about 7.5 million pounds of thrust at liftoff. When you see it lift off it looks like it will never clear the tower. But as it burns away fuel, it gets faster--the weight at lift decreases, therefore it picks up speed.***

JoAnn Morgan: ***It's quite a physical experience, an Apollo launch, because it's such a slow liftoff--and then the shock waves hit you. We could feel it happening in the firing room because we had these shutters and they would flap back and forth, rattle, and the consoles would vibrate.***

Robert Sieck: ***When you're in the control room for the launch count, you're focused on the technical data. Standing outside was like the difference between watching a sporting event on TV and being in the crowd at the stadium. People were jumping up and down, screaming and hollering, honking their horns. It was great.***

Jay Finst, Saturn V IBM Flight Computer: ***I think of it as a track relay. You have a runner, and he runs and passes the baton to the next runner, and that runner runs and gives the baton to the next runner. And, the race isn't over until the baton gets transferred to the last man and he crosses the finish line. This launch is the same way. The first stage, the S-IC, has to work, and the baton goes to the next stage; the S-II stage has to work and pass the baton to the S-IVB stage--that has to work. And you pass the baton to the S-IVB stage again, and that has to work. You've got a passing of the baton four times to have a successful mission.***
The firing room had people from all [the manufacturers]. I'm sure the Boeing people held their breath that the first stage, S-IC, would do its job. Then, they had the S-II stage, the next stage, and I'm sure the North American people held their breath that it would fire and do its job. And you had the S-IVB stage and it would fire its engines. And again, you had someone, the S-IVB people from Douglas, holding their breath.

Jay Finst: ***Nobody left the firing room, even if your boosters were done, to see if the S-IVB would have its second start. The unique thing about that engine is that it runs once and you have cutoff for two or three hours and then you have to start it again. And the second start, which is what everyone waits for, is the long burn that then takes the spacecraft toward the moon.***

H. David Reed, flight dynamics officer (FIDO), Green Team, Mission Control: ***Once that burn is shut down and everything is stable, the crew pops off the front end and turns around to get the lunar module. Then they rotate again and begin to put distance between themselves and the booster. Once you've got the lunar module captured, from that point on you have a lifeboat.***

JULY 16-19, 1969: SEEMINGLY ADRIFT; THE RIDE TO THE MOON

Editor's Note: LIEF member Tom Hancock, is part of our Wednesday work group. One day while we were having lunch, Tom related a story about working on the LM program at Grumman. Tom explained that NASA had a group of women with strong math skills. These women calculated the course and trajectory for all of the NASA missions……and they did it with slide rules; this was a time before computers as we know them today, In fact these women were called "computers." One of these ladies was visiting Grumman in preparation for the moon launch. She explained the great detail of calculating the course to the moon. She gave the example that at the halfway point, the trajectory had to pass through a slice of space that was about 2 miles wide and 8 miles tall. If a circle was drawn in the middle of that plate, it was representative of the ideal path for the spacecraft to pass through on its way to the moon. Outside of the circle, and the course could be corrected, but outside of that rectangle, the capsule would be too far off course. The work these ladies performed was depicted in the motion picture *"Hidden Figures."*

Charlie Dumis, electrical, environmental and communications officer (EECOM), Green Team, Mission Control: ***As soon as it lifted off, it became ours.***

Joe Gavin, director, Lunar Module Program, Grumman Aerospace Corporation: ***Across the hall [at Mission Control] there was a group of about a half a dozen engineers, some from Grumman, some from North American, who were the first line of backup to the Mission Control team.***

Charlie Duke, astronaut, capsule communicator (CapCom), White Team, Mission Control: ***The actual communications between the mission control team and the crew was always done via the CapCom, who was an astronaut. The thought was that a crewman in Mission Control would have a better understanding of what the crew was experiencing.***

Gene Kranz, flight director (FLIGHT), White Team, Mission Control: ***We always operated with four teams during the lunar missions. We did this to balance the training workload, and because shifts are pretty long, it gives 'em a break.***

Steve Bales, guidance officer (GUIDO), White Team, Mission Control: ***We were all in the 25 to 28-year-old range except for Gene, who was 35. People who were drawn to NASA at the time were younger; it wasn't as if anybody had done this particular job before. The crew, they were all 38, 39, 40--they seemed a lot older to us. Or at least to me, anyway.***

The "old guys" – Neil Armstrong, Mike Collins, Buzz Aldrin

Neil Armstrong, commander, Apollo 11: ***I was 24 when I joined NACA--later NASA--and was given very challenging work both as a pilot and as an engineer in flight research. I was confident that men of that age could do the job. Additionally, this new Space Age required people who understood digital computers, and most of the people in that category were in their 20s.***

Jack Garman: ***Nobody knew much about computers in those days--and nobody knew much about flying spacecraft either. If people thought, "Are a bunch of young kids gonna screw up this mission?" we never heard it.***

Chris Kraft, director of flight operations, Mission Control: ***On the way to the moon, you might say, "Well, that could be a pretty boring time." But that's not true. There were times when you had to do things with the fuel cells, when you had to get rid of the water in the system. You're making sure the thermal operation of the spacecraft is being done well. On Apollo it was called barbecue mode.***

Hugh Blair-Smith, software engineer for the Apollo guidance computer, MIT Instrumentation Laboratory: ***For the long three days from the Earth to the moon they had to keep the spacecraft rotating just like a pig on a spit so the sun wouldn't be concentrated on any one side.***

H. David Reed, flight dynamics officer (FIDO), Green Team, Mission Control: ***There's a lot of outgassing from the service module--venting stuff overboard. That will change the trajectory. If you're going 238,000 miles out, and walk up to the side [of the craft] and even blow on it, that slight movement will be multiplied by a lever 238,000 miles long. So we'll track it for a while, notice the trajectory is changing and make a midcourse correction.***

Hal Loden, lunar module control officer (CONTROL), Black Team, Mission Control: ***You don't want to hit the moon, but when you do miss it, you want to miss it at the right altitude and inclination so that you'll go into orbit.***

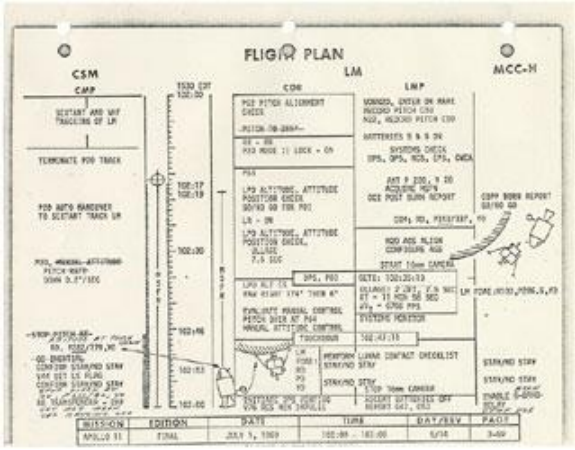
John Llewellyn, retrofire officer (RETRO), Green Team, Mission Control: ***In those days, we didn't have GPS and all that stuff. The crew didn't have any of that either. They had almost the same thing Columbus had--a sextant and a star field.***

Neil Armstrong: ***In all of science fiction—Jules Verne, H.G. Wells and others—no writer had ever envisaged that lunar explorers would be in communication with people on Earth or, even more surprisingly, be able to transmit still pictures or moving images back to Earth. So we understood that was an important component of our flight objectives.***

John Llewellyn: ***When you launch from the Earth, when you first see the moon, it looks small. Days later, every time you look at the moon it gets bigger and bigger and bigger……finally it gets so big you can't see anything else.***

Buzz Aldrin: ***[We were] just watching the Earth fade away slowly. The stars were not changing--sometimes they were visible because the ambient light is pretty low. All of a sudden, somebody noticed out the window that the moon covered up the sun. It was a big black object, much, much bigger than the sun, and the sun was backlighting it. Wherever the Earth was, it was not shining enough to cause any earthshine because the glow around the edges [of the moon] was so predominant and just going out in every direction. No eclipse pictures or movies I've ever seen showed a corona like that.***

Chuck Deiterich, retrofire officer (RETRO), Black Team, Mission Control: ***When you get out toward the moon, we always try to have several maneuvers in the hands of the crew, so if they lose communications they can get back to Earth. Five hours prior to going behind the moon, we had a maneuver where you could fly around the moon. If for some reason you didn't go into lunar orbit, we had a maneuver that would allow you to get back to [Earth for a] good water landing. If you had a problem during lunar orbit insertion--that's a big burn--we had prepared a chart that said if you shut the engine down at this time, this is what you do to recover.***



When Apollo 11 passed behind the moon, and out of contact with Mission Control, a 6-minute burn placed the craft in an elliptical orbit. Two orbits later a second lunar orbit insertion burn, also behind the moon, lasted for 17 seconds and dropped the vehicle into a circular orbit.

Bruce McCandless, astronaut (CapCom), Green Team, Mission Control: ***Shortly after Apollo 11 dropped into orbit around the moon, Frank Borman got a message from the Soviet Union that said, "Congratulations on reaching lunar orbit. We have Luna 16 also in orbit around the moon and its orbital parameters are such and such. If it presents any problem, please advise and we will move it." We didn't need Luna 16 moved, but I thought it was a noble gesture in those days of the Cold War.***

JULY 20, 1969 — THE LANDING

Gene Kranz, flight director (FLIGHT), Mission Control: ***I remember very clearly when I left the house. I had my fresh haircut, and my wife had packed me a sack lunch that was enough for three shifts of people. As I arrived at my parking spot at [the Manned Space Flight Center], I realized I didn't remember driving through Clear Lake, or anything else. I was so preoccupied I was on autopilot.***

Steve Bales, guidance officer (GUIDO), White Team, Mission Control: ***When we came in that morning, the lunar module was dead. We had to power it up, get the thing aligned and checked out. In the simulations, that's where we'd always had the biggest difficulty, really. We had never completed without some major problem--and I don't know if we ever completed successfully in training--what we called a power-up and initialization of everything, and then gone ahead and done a landing.***

Sy Liebergot, electrical, environmental and communications officer (EECOM), Black Team, Mission Control: ***We had both the descent team and the ascent team in the Control Center at the same time. If we had to abort and get off the lunar surface, the descent guys would move off the console and we ascent guys would move into position to perform the part of the mission we were specially trained for.***

Chuck Deiterich, retrofire officer (RETRO), Black Team, Mission Control: ***Coming from an abort there are many places you could start from, so that made it more complicated. But the abort target tries to get you to a point that simplifies the rendezvous.***

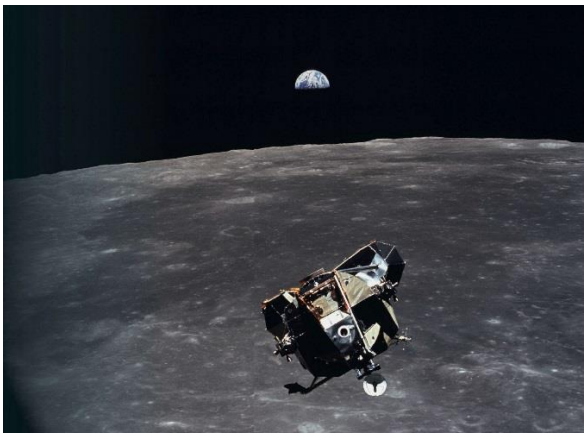
John Llewellyn: ***I used to go into the Control Center at night by myself and bring up the computer; I'd work with Collins in the simulation building. He'd simulate aborts and I'd tell him what kind of orbits he got into and talk about how we handled it. That really kept me on edge.***

Gene Kranz: ***I had a talk with the controllers prior to the time we entered into the landing phase of the mission. I indicated that whatever decisions they'd make that day, I'd stand behind them--that we came into the room as a team, and we'd leave as a team.***

Jack Garman, group leader, program support group, Apollo Guidance Software Section: ***It got very, very real as [the spacecraft] went around the moon and got ready to undock. In fact, I remember vividly them locking down the Control Center. The guards were not to let anybody in or anybody out.***

Buzz Aldrin, lunar module pilot, Apollo 11: ***At that point we're maneuvering to go backwards, engine first and facedown, in the attitude where we're going to start the powered descent.***

Joe Gavin, director, Lunar Module Program, Grumman Aerospace Corporation: ***The whole thing was tense, because we were basically aircraft designers. In the aircraft business you always flight tested something before you delivered it. In the case of the lunar module, you couldn't flight test it. Every launch was a brand-new vehicle.***



Doug Ward, NASA public affairs officer: ***All the way down we kept losing communications and it would come back and we'd lose it again. I was right on the edge of my seat thinking, "You know, we're gonna abort for that." In fact, the people responsible for communications weren't overly concerned because they realized why it was cutting out. The lunar module was getting in an attitude where it was blocking the high-gain antennas. They knew that as it maneuvered going down to the lunar surface, that would correct itself.***

Gene Kranz: ***I had one Mission Rule that I was sole interpreter of. That was: Did we have enough information to continue—both voice and telemetry.***

Glynn Lunney, flight director (FLIGHT), Black Team, Mission Control: ***Mission Rules were sort of like what it would take for us to stop trying to land on the moon. They became like a set of commandments, or a set of ethics for helping to figure out how much risk we were willing to take, and for how much reward.***

Bob Carlton, lunar module control officer (CONTROL), White Team, Mission Control: ***When we first kicked it off, the flight director would go around the room and take a status. He wanted to hear your voice. When Gene got to [Steve Bales], he just exploded "GO!" And I heard Gene snicker a bit, and we all did, but it sort of relieved the tension. I said to myself, "Now you don't do that." So when I gave my go, Gene said, "Control," and I said, "I'm go, Flight." He later commented on how cool and calm I was, but he didn't know I was putting on an act.***

Gene Kranz: ***We gave 'em the go for the start of powered descent and, doggone it, right at the time the engines started we lost data again. We picked it up momentarily thereafter, and very shortly after that a guidance officer indicated we had some trajectory perturbation. In fact, he said, "We're halfway to our abort limit." Well, that is sort of sporty before you even start down to the surface.***

Buzz Aldrin: ***We're about a minute, maybe 2 minutes, into powered descent, facedown, and Neil says to me, and the Earth, "I think we're gonna be a little long." I said to myself, how in the world can he really, at this point, tell that we're gonna be a little long? But sure enough, we were.***

Neil Armstrong, commander, Apollo 11: ***Prior to igniting the lunar module's descent engine to initiate the trajectory toward the lunar surface, I had been timing our angular rate over the craters on the surface below to calculate our altitude. I noted that, at ignition, we were somewhat west of our intended starting location. I inferred that our entire trajectory and landing point would be somewhat west of our planned landing spot.***

Buzz Aldrin: ***I've learned that whenever Neil says anything, you'd better pay attention because there's good meaning to it.***

Steve Bales: ***The lunar module could do a lot of things independently, but it had to rely on people on the ground to tell the computer where it was starting on its landing position. On the backside of the moon there had been some venting--some perturbations unknown to us. The time we gave them to light the engine was about 4 or 5 seconds late.***

Buzz Aldrin: ***There comes a point in the checklist where we yaw around so that we're faceup, then pitch forward a bit before we throttle down. The purpose of doing that is to get the landing radar to lock onto the surface at about 30,000 feet.***

Steve Bales: ***As the lunar vehicle pitched over, the landing radar had to change positions. We'd always said that if that switch didn't happen at 10,000 feet, we were going to abort. The day before we landed, I was in a meeting with 30 or 40 people who built the radar, who built the computer, who knew the landing trajectories, arguing about what we were going to do if the radar gets hung up in the primary position.***

Gene Kranz: ***We had given the spacecraft the best knowledge we had of its altitude above the lunar surface prior to powered descent, but we had to update it based on actual data from the radar.***

Steve Bales: *As soon as it locked on, the radar saw that we were going a little bit fast in radial velocity and corrected the computer. At the time, I thought our worst problem was over. It turned out our worst problem was just about to start.*

Buzz Aldrin: *We got the first 1202 alarm. So we look at each other, and we know it's in the guidance and navigation dictionary, but rather than try and get it out while the module is making a powered descent, Neil asked them what's the reading on the 1202 alarm. Then we got a 1201.*

Charlie Duke, astronaut, capsule communicator (CAPCOM), White Team, Mission Control: *I was shocked. Actually, "stunned" is a better word. I started reaching for my guidance and navigation checklist to see what a 1201 and a 1202 was. And, of course, Steve Bales knew immediately and didn't hesitate very long to say, "We're go on those alarms, Flight."*

Steve Bales: *I barely heard him. If you listen to the voice loops, there's a lot going on. And then finally the data comes in and we see the 1201, and Jack Garman is yelling--I mean, almost literally yelling, "It's okay! It's okay, as long as it doesn't keep going on!"*

Jack Garman: *There was a team of flight controllers whose duty it was to come up with simulation profiles that train the flight controllers and astronauts together to survive and fix things. At one point, they had asked me to come up with a failure that was totally software-related. I did that months earlier, and they stuck that in during one of the simulations.*

Gene Kranz: *Dick Koos, our simulation supervisor, gave us the 1201 and 1202 alarms. Steve [Bales] had never seen this before. During the simulation, they had an abort, which was his call.*

Steve Bales: *There's a general rule in flight control: If you don't know what to do, don't do anything. The problem is, in the middle of a lunar landing, not doing anything is not an option.*

Jack Garman: *Gene Kranz sat us all down and said, "I want you to figure out every possible alarm code that can happen in flight so that we're prepared." In those days, there was no such thing as desktop computers. So I wrote down all the alarm codes on a sheet of grid paper, with crib notes on what they meant and what our response should be. And I stuck it under the plexiglass of the console I was to sit at. And, lo and behold, one of them--well, a couple of them--popped up during the actual landing.*

Don Eyles: *What led to the alarms, was an obscure mismatch deep in the electronics--two signals that should have been locked together in phase were only locked together in frequency. That hardware glitch involved the rendezvous radar, which really wasn't needed during the descent to the moon.*

Buzz Aldrin: *I left it on. That turned out to be the main cause, and maybe the cause, of the program alarms.*

Don Eyles: *Under the software control, it did a software restart. Five times during the landing, the whole software was flushed and reconstructed in terms of what was being executed. And that load shedding was what allowed us to complete the landing without any appreciable glitches in the way the guidance system worked. Without quite knowing it, we had built a fault-tolerant computer.*

Jack Garman: *The problem is that those program alarms set off what is called the "master caution and warning," which is red lights and very large klaxon sounds--if you've seen submarine movies, kind of like the klaxon that goes off when they say, "Dive! Dive!" And as I gathered from after-flight readings, the heart rates for Neil Armstrong and Buzz Aldrin went up just a bit.*

Neil Armstrong: *The powered descent was the most challenging segment of the flight. The systems were heavily loaded, the margins were slim, and this would be the first time that the entire descent strategy would be fully tested. A decade earlier, while I was flying in the X-15 program, we learned, surprisingly, that all the pilots, while flying the X-15, had heart rates between 145 and 185. It reflected the mental intensity appropriate for a challenging situation. The Apollo data seemed to correlate well with our prior experience.*

Charlie Duke: *I didn't notice anything panicky, any tension at all in them. We just kept feeding them the information, trying to be as professional about it as possible. I don't think I was relaying any anxiousness in my voice--I tried not to, anyway--but tension was building.*

Buzz Aldrin: *As long as you've got communication, Houston knows what [the problem] is, and they have more information, so they're going to be the ones that call the shots.*

Sy Liebergot: *We weren't exhaling, but very businesslike. And that's not to say the job was just ho-hum; it was not. It's that we, with hearts racing, did our job.*

Don Eyles: *The first two landing phases were very much under the computer's control using different targets. The final landing phase was the point where the astronauts took over semi-manually to maneuver the spacecraft like a helicopter. When I say semi-manually, I mean that the automatic system was controlling the throttle to maintain a commanded descent*

rate while the astronaut commanded the attitude of the spacecraft in order to scoot along the surface in whatever direction he needed to go.

Bruce McCandless, astronaut (CAPCOM), Green Team, Mission Control: *Neil was flying, looking for a boulder-free spot. It's fair to say people were holding their breath. But Neil had a considerable amount of experience in the lunar module simulator and in the lunar-landing research training vehicle.*

The Lunar Landing Research Training Vehicle.

Neil Armstrong: *Every flying machine has its own unique characteristics, some good, some not so good. Pilots naturally fly the craft in such a manner as to take advantage of its good characteristics and avoid the areas where it is not so good. In the case of the lunar module, surprisingly, it flew much more smoothly than I had expected based on all the simulator work we had done. It was a welcome surprise.*

Joe Gavin: *The lunar module had the first really throttle-able descent engine. When it first fired, it had to operate at about 10,000 pounds of thrust. But as they approached the lunar surface, the vehicle became much lighter, having burned up a lot of fuel, and they had to get the thrust down to maybe 2000 pounds. So it was quite a development to get a rocket engine that would not only do this, but would operate smoothly in either range.*

Steve Bales: *There wasn't a lot being said, but we had a lot of data. I was thinking, "What in the bloody heck is going on?" Normally, in the simulations, once [Armstrong] got on a path to come down, he killed all the velocities but altitude rate and pretty much just came straight down. But he wasn't. He had a forward velocity of 20 feet per second. And, of course, that was eating up fuel.*

Gene Kranz: *We got what we call "low level" in the propellant tank. Once we got that indication, we knew we'd have roughly 120 seconds of propellant remaining at a hover throttle setting.*

Flight Director Gene Kranz

Jack Garman: *At that point there was nothing the ground could do except watch.*

It became a spectator activity. The tension went up noticeably. Very noticeably.

Charlie Duke: *When we got down to the last minute or so, it was real quiet. Everybody was glued to his monitor.*

Bob Carlton: *I had a stopwatch. I'm looking at it, and at the same time I'm looking at the altitude, and I can see it's still a long way down. I didn't know it, but the guys were flying over a crater. We call up 30 seconds. I'm thinking there's no way we're going to make it.*

Gene Kranz: *I'm a Catholic, and in the flight director business, you want all the help you can get.*

Bob Carlton: *When the engine shut down, I had 18 seconds to the point where we would have aborted.*

Bruce McCandless: *I was in the control center as a spectator, sitting right next to Charlie Duke, who was the CAPCOM. Once Neil came back with his transmission, "Tranquility Base here. The Eagle has landed," in spite of the earlier admonitions to maintain decorum, we burst into spontaneous cheers and applause.*

Charlie Duke: *That's the first time he'd used that. The call sign was Eagle, so we'd just been using, "Eagle, this is Houston," "Houston, Eagle." As you can hear in the transcript, I was so excited, "tranquility" came out, "twank." I caught myself before I finished the word, "Twank--I mean, Tranquility. Roger, Tranquility, we copy you down."*

Doug Ward: *Kranz immediately got on the loop and said, "Everybody settle down. Settle down. We've got some critical calls to make, and we've got to focus on what's coming up here."*

Gene Kranz: *We had a job to do, because in the next 2 minutes, we had to make the first of our stay/no-stay decisions.*

Buzz Aldrin: *It was certainly momentous, but there were no trumpets blowing or cymbals crashing. We're there, we're two guys, and we're not the yippee type. We see something, absorb it, think about it and that's it, accept the way it is.*

EXPLORING THE MOON

Bruce McCandless, astronaut (CAPCOM), Green Team, Mission Control: *After they were given the "stay" call and shut down lunar-module systems, I headed for home, which was about 10 minutes away, to get a bite of dinner. But when I was pulling into the driveway, my wife came running out waving her arms. "They can't sleep! Go back!" So I turned around.*

Doug Ward, NASA public affairs officer: ***The original plan was that they weren't going to get out of the lunar module until the next day. They were going to get 8 hours of sleep and the next quote-unquote morning go do the first extravehicular activity.***

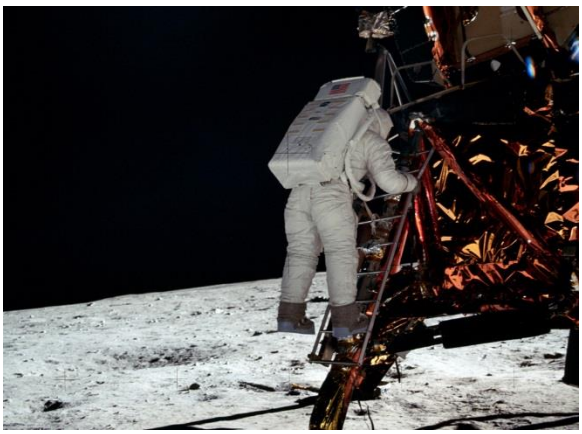
Buzz Aldrin, lunar module pilot, Apollo 11: ***We wanted that to be the way the flight plan read, so that if we made a change, it was a change in the positive direction, not in the negative direction.***

Milt Windler, flight director (FLIGHT), Black Team, Mission Control: ***It was a pretty easy decision. You probably can't stop them, so why not go ahead and do it? Plus, we were all ready to get on the moon, too.***

Bruce McCandless: ***Driving back out to the center along NASA Road 1, it just so happened I was aimed right at the moon, which was nearly full. I had this eerie feeling that the moon didn't look any different to me from where I was here on Earth, and yet intellectually I knew the lunar module and Armstrong and Aldrin were on it and I'd be talking to them. It was one of those "This does not compute" type things. It wasn't until I got inside the control center and was talking to them that everything seemed to come back into the realm of reality.***

Don Beattie, program manager, Apollo Lunar Surface Experiments: ***One scientist had projected that when the lunar module landed it would disappear into levitated dust. Even though we landed the Surveyor spacecraft successfully, that was a real concern. Another was that the dust would be pyrophoric--that when they opened the cabin of the lunar module, oxygen would react with dust and explode. There was no way we could be sure until the guys opened up the door and the oxygen flowed out.***

Bruce McCandless: ***It was a relief that the dust on the lunar surface was actually only half an inch deep.***



Bruce McCandless: ***I had asked Neil before the mission launch several times what he was going to say on the occasion of the historic moment, setting foot on the lunar surface, and he always replied, "I'm a test pilot, I'll probably just say how dusty it is or something like that. Don't worry." But he came back with his now famous line. The media immediately wanted to know if it was one small step for a man, or just man. There was a little bit of static, so it wasn't entirely clear.***

Bruce McCandless: ***The first order of business was collecting a contingency***

sample. Neil was supposed to scoop up whatever was near his feet, the first thing that was handy, so that in the event of an emergency they would have at least something to show for having been there.

Harrison H. Schmitt, astronaut, mission scientist for Apollo 11: *The Apollo astronauts were very well trained engineers to begin with, and they were test pilots as well, which meant that they had very, very good observational skills. So we tried to give them a fundamental understanding of what they were going to encounter and the types of samples that we hoped that they would be able to collect.*

Don Beattie: *The most important was the seismometer. That was going to tell us whether there were moon quakes, and possibly also something about the internal structure of the moon. Then we had the lunar retro reflector, which was deployed in order for us to take accurate measurements of the Earth-moon distance.*

Bruce McCandless: *The mission was about 2 hours and 20 minutes in duration. About 15 minutes into it, the flight director gave an advisory that President Nixon wished to speak with the Apollo crew. After a little consultation, we decided it was President Nixon's prerogative to talk to the crew, but we had a lot of work to do before we felt we could afford the time and the minor disruption to the schedule. So we basically put him off for a little over an hour. We got the impression he was getting increasingly unhappy. But slightly after the midway point, we did get him on. I got Neil and Buzz to stand near the flag, within view of the TV camera, and [Nixon] talked for a couple minutes.*

Harrison Schmitt: *Once an extravehicular activity starts the crew is going to move along the timeline and get as much done as they possibly can. Buzz Aldrin was talking about a lot of things that he was checking, like mobility.*

Buzz Aldrin: *After the flag was up, I made a point of being in front of the camera just demonstrating different means of moving around.*

Harrison Schmitt: *While he was doing that we were all wondering what Neil was doing. Well, Neil was...collecting this very fine and diverse group of rocks and soil. Not only did he get a very wide distribution, but he also thought the box looked a little empty, so at the last minute he filled it with just the dirt, so to speak--what we call the lunar regolith. That sample turned out to be the best, most comprehensive sample of the lunar regolith that was ever taken on any of the Apollo missions.*

STARTING FOR HOME

H. David Reed: *I took my headset off, which is what you do if you don't want anybody to hear what you are about to say, and told Gene [Kranz], "We have a problem: We do not know where the hell they are." There was only one way to figure that out. The capcom woke Buzz Aldrin one rev early to do a rendezvous radar check. Because I knew where the command module was and I had the vectors that allowed me to translate back down to the surface, I could find out where the lunar module was. They were off another 5 miles from anything that we had.*

Joe Gavin, director, lunar module program, Grumman Aerospace Corporation: *In my mind, the riskiest unknown in the whole mission was the takeoff. When the astronaut pressed the button, a whole bunch of things had to happen. The explosive bolts connecting the two stages had to fire. And then the ascent engine had to be ignited to lift the ascent stage off. And somehow as it left the descent stage, the exhaust from the ascent engine had to go somewhere.*

Chuck Deiterich, retrofire officer (RETRO), Black Team, Mission Control: *We also kept track of the rocks in the LM and where they were stored. We had a computer model that had all the cabinets and cubbyholes and things. The ascent stage of the engine did not gimbal--they used little RCS jets to keep it stable--so if the center of gravity got too far off it would not fly. You had to have all those rocks pretty much where you wanted them.*

Owen Garriott, astronaut (CAPCOM), Maroon Team, Mission Control: *The engine on the lunar module has one chance, which must be perfect. People had spent a lot of time back at Grumman doing the design, preparation and testing for it.*

Buzz Aldrin, lunar module pilot, Apollo 11: *As I got down on the floor to sleep [the night before], I could see the broken head of a circuit breaker. It was the engine-arm circuit breaker--the one that's got to be in to get electricity to turn the ascent engine on. Since it was on my side, obviously I would have to take the blame for my backpack knocking against things clumsily and breaking it off.*

Hal Loden, lunar module control officer (CONTROL), Black Team, Mission Control: *That circuit breaker allowed the lunar guidance system to start the engine automatically--but there was another way to start the engine. We had redundancy. They would have had to hit a pushbutton manually at T minus zero.*

Buzz Aldrin: *It looked as though there was enough left to push [the breaker] in. When the time came, I just said I was going to push it in with a pen.*

Glynn Lunney, flight director (FLIGHT), Black Team, Mission Control: *Once the ascent stage is lit, the vehicle really jumps off the moon.*

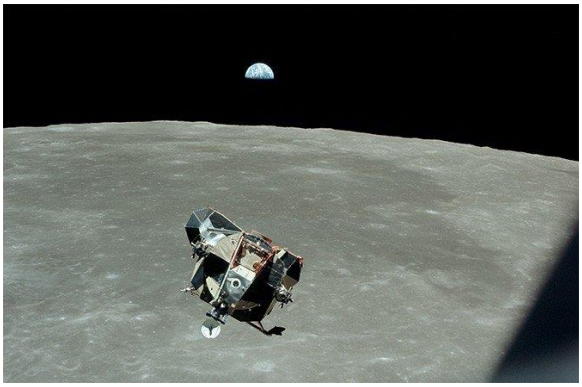
Buzz Aldrin: *It was not a gradual liftoff. It was a sudden departure--but without any of the forces that go along with rapid acceleration. Looking out the window, everything was getting smaller so fast that [we didn't really notice] the craft going through a gradual pitch forward.*

Joe Gavin: *The original von Braun approach was everything that got out to the moon would go down to the surface and then back up. It was absolutely vital to the success of the whole enterprise to have a separate vehicle to do that, because it saved the energy that would have been involved in taking a lot of extra weight to the surface of the moon and then back up again.*

Chris Kraft: *What drove that, more than anything else, was the performance of the rockets and the complexity of the systems involved on one or two spacecraft. You could separate that by having two modules. And the real kicker, in my opinion, was that when you tried to do it with only one module, the vehicle ended up being so tall, so long, that the pilots were a long ways away from the surface that you were trying to land on.*

Hugh Blair-Smith, software engineer for the Apollo guidance computer, MIT Instrumentation Laboratory: *The lunar orbit rendezvous wasn't that different from what the Geminis did in Earth orbit. But it was more nerve-wracking because if it didn't work, where everybody would be left was not going to be very good for them. Deciding to do the lunar orbit rendezvous, to put the pieces back together to come home, took big, big balls. But they did it because everything else had much bigger problems.*

Joe Gavin: *It was an emotional worry that people had. But those of us who were directly involved with the details were always very confident--otherwise we wouldn't have said we were ready to go.*



In order to dock with the command /service module, the lunar module executed a series of burns—including two behind the moon—in a complex sequence lasting nearly 4 hours.

Joe Gavin: *When the vehicle was behind the moon, there is no communication. The control team always had a timeline that*

said communication should resume at this hour, this minute, this second.

Bruce McCandless: *There's not much you can do other than stand there and look at these old black-and-white TV screens with cameras trained on systems for generating numerical data. When we acquired a lock on their radio signal there was one indicator that went from a down arrow to an up arrow. There would be a sort of palpable feeling of relief.*

Chuck Deiterich: *When they came whipping around the moon, [the crew] had already closed out the LM. The systems engineers were concerned about flying for two more hours with the coolant loops turned off. We were in a particular attitude that was really not good for jettisoning the LM--that attitude was set up for 2 hours later. When we popped [the lunar module] off, it was drifting up and away. The problem with that is, one rev later, it's going to come right back to the same spot that you're in--so you have to do an evasive maneuver. About 20 minutes later we did a CM retrograde burn; in other words, we actually slowed the orbit down by 2 feet per second. What that does is put you out in front of the LM, so when you do TEI [trans-Earth injection] you continue to move away from it.*

Bruce McCandless: *Lunar orbit insertion was critical to a mission's success, but it was less critical to the survival of the crew than the trans-Earth injection burn. If you couldn't get out of lunar orbit you had a real problem. It pretty well boiled down to the SPS--service propulsion system--engine; that had redundant valves, circuits, actuators, switches. Everything was singlefold redundant. If it didn't fire automatically it was possible to fire it manually but nobody really wanted to do that.*

Chuck Deiterich: *We were in good shape to do TEI (Trans Earth Insertion). But when you're doing a 2800 feet per second burn you can't do it perfectly. It only takes a couple feet per second to change what your entry conditions will be. So we have a midcourse correction about 15 hours after TEI and another one about 24 hours before re-entry.*

Hal Loden: *Of course, the lunar module stayed in orbit around the moon and we watched it die. It was like losing a good friend. But it performed its job tremendously well, and we configured certain systems in ways that, after jettison, would give us insight as to how long it could last. It was tougher than we thought.*

Bob Carlton, lunar module control officer (CONTROL), White Team, Mission Control: *The name of the game for us flight controllers was to try to learn the outer limits of all of our equipment. Some people called it playing with it, but it was serious business. We wrung that thing out.*

Joe Gavin: *The rest of the mission was a matter of waiting until orbital mechanics brought everybody back to Earth.*

RE-ENTRY AND SPLASHDOWN

Chuck Deiterich, retrofire officer (RETRO), Black Team, Mission Control: ***About 16 hours before re-entry the recovery guys came up and said, "Hey, we've got bad weather where you're going." It was too late to change the time of flight, to let the Earth rotate underneath you, so what we did was fly an entry range. You could actually fly a different trajectory through the atmosphere and land [further] downrange.***

Chris Kraft, director of flight operations, Mission Control: ***Because the velocity is so high, if you tried to come in directly, the heat-shield requirements would be too great. So what we did was get them into the atmosphere, skip it out to kill off some of the velocity, and then bring it back in again. That made the total heat pulse on the heat shield of the spacecraft considerably lower.***

Milt Windler, flight director (FLIGHT), Black Team, Mission Control: ***It was [still] so hot that the heat shield was abrading and there was a big ionization shield all around them. It prevents communication until [the command module] slows down enough for that to stop.***

Clancy Hatleberg, Para rescue-man, underwater demolition team 11, U.S. Navy: ***The USS Hornet had steamed all night long with the helicopters, the two recovery teams and myself. The sea states were the highest we had ever encountered in any of the simulated exercises that we had performed in preparation.***

Buzz Aldrin, lunar module pilot, Apollo 11: ***There's a big solidness to the force as you're coming into the atmosphere, and it's gradually decelerating the spacecraft. You could sense a g before it really showed up on the indicator, and by then it's pretty firm. It's pushing you toward the back of the couch and down.***

Clancy Hatleberg: ***I was in helicopter 66. I remember looking out of the cockpit, and I could see we were on the outskirts of a storm: The sun was rising up above the clouds, but it was dark down below. It was sort of like being caught between night and day. Then all of a sudden I saw this streak coming through the upper***

atmosphere. It looked like a meteor. And then three chutes opened up.

<u>George Mueller, associate administrator for manned spaceflight, NASA:</u> *Looking back, it was really a whole lot of people working on the same problem, making sure the piece that they had would do what it was supposed to do when it was supposed to do it--10 million pieces and 400,000 people. And every one of those people was very, very dedicated.*

<u>Sy Liebergot:</u> *We were young, and we were fearless and, after all, nobody had ever told us young engineers that we couldn't successfully land humans on another planet. So we did it.*

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L.I.E.F.C. News:

We were saddened to learn of the passing of LIEF Past President Frank Licari on March 7. He was 102. Frank had been President of our organization in 2009 and is best known for his advocacy of the Cradle of Aviation Museum during his term of office.

Frank Licari (seated) at the ground breaking for our hangar

AT OUR APRIL MEETING…….

Our first meeting of 2019 featured Islip Town Historian George Munkenbeck as our guest speaker. In addition to telling us about the aviation background of his

family, he brought several humorous items to his talk including the explanation that the name Islip means "slippery slope." We thank George not only for the interesting facts about the Town's past, but also the ways in which the land we now know as the Town of Islip, was finagled away from some of our neighboring towns!

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2019 dues payments have been coming in strong. With a membership of 153, I'm pleased to tell you that there are only 3 people who have not paid their 2019 dues statement.

We have a new plastic membership card that is in the process of being mailed to all members. About half of the cards have gone out in the mail. If you have not received your card yet, it's because they are still being processed….unless, of course you haven't paid your dues!

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We are gratified to have received additional donations from the following members:

John Sandhaas	$ 35.00
Walde Lindemann	$100.00
Ron Weyhrauch	$ 65.00
Eric Sandberg & Tom Alferman	New charger for Our Golf carts ($350.00)

Our heartfelt thanks go out to each of you. Please remember that all contributions are tax deductible! Your financial support is important to the completion of the work we have planned.

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Welcome to our new members:

Francis "Mark" Loiacono
Paul Farber
Rob Lamanna
Jonathan Harding
Peter Borneman
Patrick Peyton
John Schulz
Agustin Vichera
Kendall Leek
Joseph "Jo-Jo" Erale

Special thanks to A.J. Manfredi, who has been recruiting new members and is responsible for at least 7 new members in the past two months. Thanks, A.J.!

But we're not stopping here! Our membership drive continues……. What are YOU waiting for? Our membership application is emailed as a separate attachment so you don't have to print the whole newsletter.

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Our next Bus trip…….

Our Finger Lakes bus trip has had a strong opening response. With 27 already signed up, we are looking forward to September in upstate New York as the foliage begins to turn. We'll be visiting the Corning Glass Works, the Glenn Curtiss Museum, Bully Hill Vineyards (formerly of Taylor Wine factory fame) and the Wheels and Wings Seaplane Fly-in at Keuka Lake.

Don't miss out on this great ride through the "Southern Tier" of New York. Spaces are limited, so sign up today!

The information and sign up form is also emailed separately in order that you may print it out separately from the rest of the newsletter.

In the Hangar……..

The Wednesday work crew keeps chipping away at making our hangar a great museum. Come on by for a visit and see how interesting the place has become.

Time to smile……

Please support our sponsors:

The LONG ISLAND Early Fliers Club

Long Island Early Fliers Club, Inc. is a non-profit organization founded in 1956 and Chartered by the New York State Education Department. We are dedicated to aviation education and preserving Long Island's aviation heritage. Volunteers who want to help educate and preserve our history are always welcome. Annual Membership in our organization is $35.00 for individuals; $50.00 for families.

Donations of aviation memorabilia, aircraft and aircraft parts, aviation clothing, display quality models and items of historic significance are always welcome and greatly appreciated. Cash donations, as well as artifact donations are tax deductible. You may visit our facility at Bayport Aerodrome, Vitamin Drive, Bayport New York most Wednesdays between the hours of 9:00 a.m. and 1:00 p.m. Appointments are necessary as airports are secure locations and can also be arranged at other times for your convenience. Contact us at: L.I.E.F.C., P.O. Box 43, Holbrook, NY, 11741 or call (631)-523-5407 (Fred Coste) or fax: 631-588-2147

Sal Vitale	Pat Gallagher	Fred Coste	Joan Vitale
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