

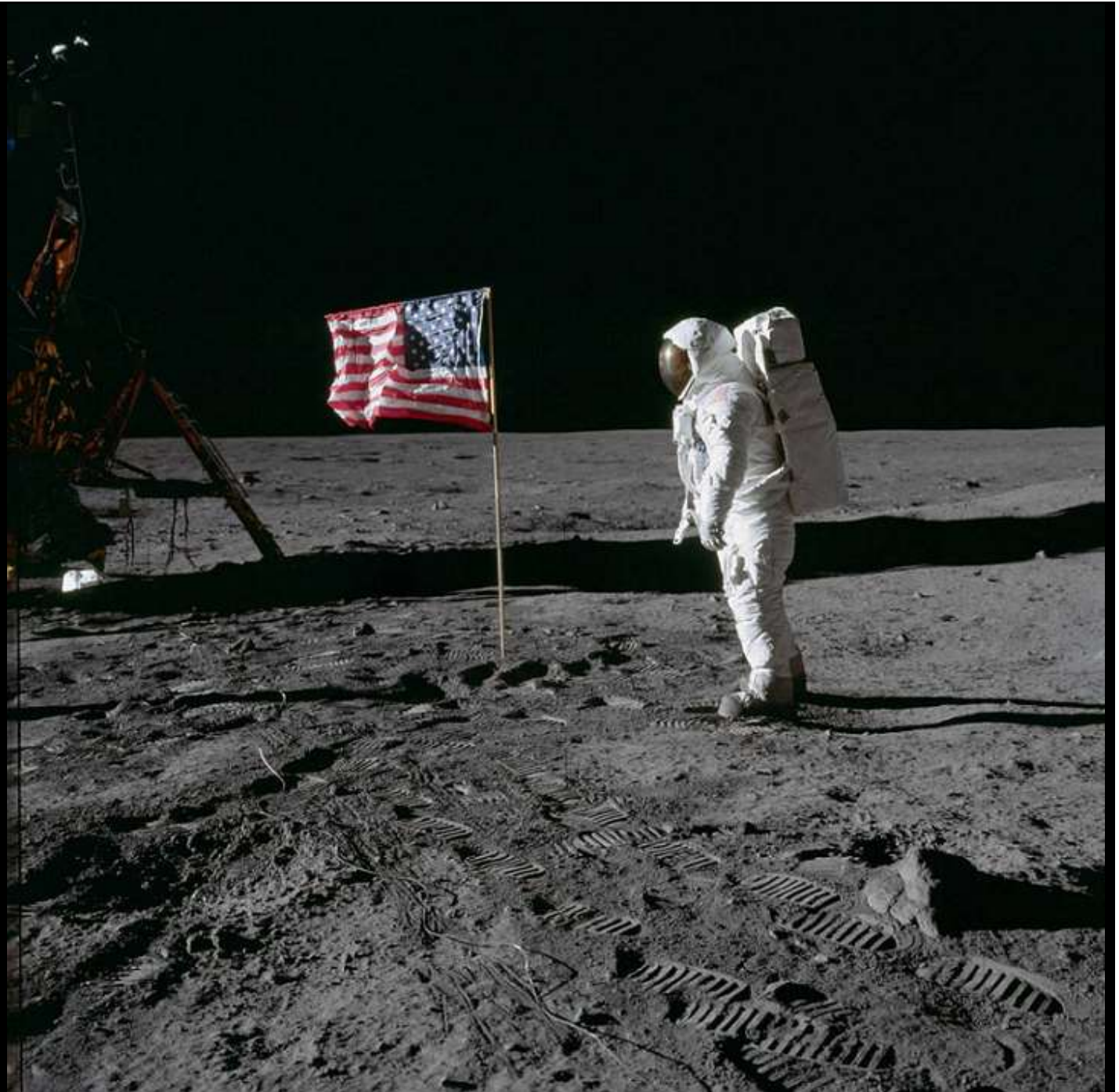
# THE WRIGHT STUFF



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# THE WRIGHT STUFF

Volume 30 - Number 4

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### IMAGES - Title Banner

Wright Flyer from NASA/Ames PAO photo archive; *U.S.S. Kitty Hawk* (USN CV-63) from [navicp.navy.mil](http://navicp.navy.mil); *Constitution* class cruiser from [gwu.edu/~rljones/khawk](http://gwu.edu/~rljones/khawk).

### IMAGE - Featured Front Page

*Apollo 11 Moon Landing July 1969.*  
Photograph of Aldrin and the US flag taken by Armstrong.  
<https://www.nasa.gov/feature/50-years-ago-one-small-step-one-giant-leap>

# The Center Seat

## By John Troan

In varying states of success... We Survived GalaxyCon! ☺ A big "Thank You!" to the setup and teardown crews. I also wish to extend a "Welcome!" to everyone added to our distribution lists through the signup sheets we had at GalaxyCon.

The [Kitty Hawk web site](#) should have [a full set of GalaxyCon photos](#) in early August, possibly before this newsletter issue is published. Our *next* issue (Sep/Oct) will have a complete roundup of reports and photos from the Con.

As you can tell from the front cover, *this* issue is our celebration of the 50<sup>th</sup> anniversary of Apollo 11. My thanks to those who were able to [volunteer at the NC Museum of History's One Giant Leap festival](#) on July 20.

Our chapter handbook is inching along. I've gotten one round of feedback based on another chapter's (old) handbook and I'm now working to get additional (and independent) feedback from a couple of other people. All of the comments will be combined to create a "starter" version of the table of contents for our handbook. Once that's complete, I'll be asking for help from anyone and everyone interested in writing a section or subsection. (My intent is to break up the writing help by section and/or subsection so that each piece is reasonably short.)

As the pieces are completed, edited, and sent to me, they'll be slid into the first draft of the handbook. The whole thing will be posted to the web site so that everyone has an opportunity to read through it and suggest changes that will go into what will become the first edition. I'm tentatively planning to make the handbook as a set of web pages and a full-length .pdf for easy download and print, but that could change between now and when the first edition is published. (Do note

that *any* final product will be electronic and available through the web site.)

One part of the handbook that will be completed and posted early is the promised Rank and Promotion system schedules – what earns promotion points and how many points are needed for each promotion on the Enlisted and Officer tracks. For completeness, I plan to also cover promotions to ranks above captain and SFMC colonel, which are submitted to and approved by STARFLEET.

The STARFLEET triannual election cycle is upon us and the nomination phase was completed with two people receiving enough nominations to advance to the election phase. Everyone with an active STARFLEET membership as of Aug 1, 2019, is eligible to vote in the election. Packets of information from and about the two candidates, their respective Vice Commander running mate, and their chosen group of Executive Board members (the department heads for STARFLEET itself) will be sent via postal service in the next couple of months. There are also several on-line forums (Facebook group, mailing list, Discourse, etc.) where questions are being asked and answered. I don't know what the procedure will be for this election cycle, but the last cycle (or two?) included a paper ballot and directions for voting electronically.

I ask that inactive/non-STARFLEET members please consider joining (or renewing) with STARFLEET. Do note that it is not required to be active-STARFLEET to be part of the *Kitty Hawk* or be on the general-info or newsletter e-mail lists.

For those that are active STARFLEET, I ask that you consider taking OTS through the Academy web site (if you haven't already). This is also not

mandatory, but would be a good way to understand how 'FLEET, the chapter, and the crew member all fit together.

In closing, I remind everyone that I'm always happy to answer questions from anyone about the *Kitty Hawk* or STARFLEET. As I've mentioned a lot (especially during GalaxyCon), I've always considered part of the CO's responsibilities is being a resource of and for information – I'll know the answer, get the answer, or point you in the direction (for things I can't do on someone's behalf).

*Esse Quam Videri*

## Computer Operations Report

### By John Troan

The [web site](#) has several updates coming up – [the next installment of Final Mission](#); [photos from One Giant Leap](#); and [more photos from GalaxyCon](#).

Continuing to follow the [Mars 2020 rover](#), [the effort to give it a name has started](#). The contest will start accepting entries from K-12 students this fall.

Building the rover continues, with the installations of [the wheels & suspension](#), [the robotic arm](#) (which also [got in a few bicep curls](#)), [the sensor mast](#), and [the sensor suite that goes on top of the mast](#). For those interested in watching the rover being built, [NASA recently announced that a web cam has been installed](#) where the assembly work is being done at JPL. The live stream is available through the [NASA web site](#) and [YouTube](#).

The mission is scheduled to launch in July 2020 and land on Mars the following February.

# Engineering Report

## By Brad McDonald

Recently, NASA confirmed that a woman will be part of the next planned moon mission, named Artemis. The official announcement was made in early July and added that the candidate is currently at NASA and is an astronaut with much experience with *I.S.S.* missions. No names were given so the speculation had already begun!

Several months ago I spoke of a Japanese mission to an asteroid. The [Hayabusa2](#) space probe is still collecting data on the asteroid Rugu but will begin its return voyage soon, as it is scheduled to be back on Earth by late 2020.

A lake had been discovered, or rather believed to be, under the south pole of Mars. Confirmation will be needed and NASA is already outlining a mission and designing a probe to confirm its existence.

SpaceX's *Starship* concept has had its engines successfully tested, but it's still a long way before actual flights begin. Those tests will be done on the much-reduced scale test vehicle *Starhopper*, probably by the time you read this. Actual tests of *Starship* are not scheduled to start until late 2020 or early 2021. If you haven't seen *Starship*, it's nothing like the *Enterprise* and much more like a 1930's, 1940's or 50's throwback, reminiscent of Buck Rodgers or Flash Gordon. TCM recently showed the 1950 sci-fi classic "Destination Moon" and the rocket looked a lot like *Starship*.

Another Elon Musk project, the Hyperloop, is a low pressure tube and capsule transport system, capable of speeds of 600 mph. The latest incarnation is currently under construction in Dubai. A shorter tube was built in Nevada and has already been tested, but the new one will be much longer. There may be a problem with the windowless capsules and tubes as they may make some feel claustrophobic,

even if they are not. Also, with hyper-speed and acceleration, some people may not be able to handle it. The biggest issue, though, concerns how to get out of an enclosed system in case of emergencies. The system is supposed to be more eco-friendly and travel costs should be more in line with current rail or air travel. The ride should be more comfortable and safer as there won't be any outside influences such as traffic, air turbulence, weather and other such problems.

Meanwhile, *Crew Dragon* passed another test that focused on the pad abort system. There is still a long way to go, but things are looking good.

A major milestone was reached on July 10. After eight decades, the last Volkswagen Beetle was built. This is the original design, not the recent retro look Beetles. Production had already been shut down at all previous locations so the Pueblo, Mexico, factory remained as the last producer of the iconic car. Officially, it's known as the Type I and the van is the Type II. Over the years, only two redesigns were made and over 23 million were produced. It was conceived by Hitler, (yes, that one), and designed by Ferdinand Porsche, (yes, that one, too.)

Recycling is going through a major change. The U.S. produces three times the global average of trash with about 234 pounds per person. That creates 239 million tons of which 35% is recycled. Only 16% is recycled by the rest of the world. However, Germany is an outstanding exception as they recycle 68% of their waste. The problem facing the industry is that some of the recycling resources are drying up. China, once a leader in recycling, no longer accepts outside shipments. A number of recycling companies are actually losing

money and several have ceased or reduced services. Particularly hard hit are the comingled recycling operations. Personally, I have been witness to this, as our current trash removal service at work has notified us that only cardboard will be recycled starting this fall and our comingled dumpster was removed the week of July 15.

That's about it for now. Have a good rest of the summer!

# Science Report

## By Diane Ripollone

### JUNO: Jupiter's Mission

[Juno](#) is the mission that launched in Aug. 5, 2011, and traveled 2.8 billion kilometers to arrive at Jupiter on July 4, 2016. According to lead scientists and investigators, the mission has uncovered some of the mysteries of Jupiter. *Juno* isn't the first mission to fly to the planet, [Pioneer 10](#) and [Voyagers 1 and 2](#) observed the planet for the first time. Then in 1995, [Galileo](#) orbited the planet. Most of these missions only touched the surface of the planet. *Juno* is going deeper into the atmosphere to find out what is really going on. It's predominantly hydrogen and helium, with a thick atmosphere and some sort of core exist on Jupiter. But that is all we know; *Juno* intends to answer these questions about Jupiter.

*Juno's* orbit follows a polar path, with longitudinal strips being mapped to collect vast amounts of data. It is coming the closest ever to the surface of the planet, 3,400 kilometers. As *Juno* maps the planet, it can see through the

clouds with its radiometer, taking measurements deep below the clouds. Now scientists will be able to stitch together a map of the planet's atmosphere.

One surprise that occurred was the distribution of ammonia on the planet. They discovered a concentration of it at areas north and south of the equator, while other areas are depleted, implying that there is circulation going on deep within the atmosphere. And as for the core? Before *Juno*, there were theories that ranged from a solid core to no core at all. Now it seems likely that a core exists. What the makeup is they don't know yet. *Juno* is taking gravity measurements to find clues to figure this out. Jupiter has an unusual magnetic field and one of *Juno's* investigation is find out about this field. By mapping the planet, scientists will be able to map the magnetic field. The high-resolution map will create a map of the interior magnetic fields. Scientists have already investigated the Great Red Spot and found it to be a storm that extends to very deep depths of the atmosphere and contains a lot of mass. The storm is driven by heat from the interior of Jupiter, which causes the storm to rotate. Using the JunoCam, a camera that can be used by the public, citizen scientists have come up with some amazing views of storms. You can get involved and check this out at [www.missionjuno.swri.edu/junocam](http://www.missionjuno.swri.edu/junocam).

*Juno* will remain at Jupiter until late 2021, then it will be directed into Jupiter's atmosphere. This is NASA's way of protecting Jupiter's moons for future research.



## Science Tidbits By Mohamed Noor

### Biology on Planet Kaminar

**Please note—this article has spoilers associated with season 2 of *Discovery*.** *Star Trek: Discovery*, especially in the second season and the "Short Treks," introduced us to life on the planet Kaminar, and especially the biology of "Kelpiens", such as Cmdr. Saru. As a biologist, I'm very curious how the species is represented, and how it matches species we see on Earth. So, let's dig a bit into this interesting ecosystem.

Kelpiens are perhaps best-known for their so-called "threat ganglia" that stand erect on the back of the neck when the individual senses danger. The show is a bit inconsistent about whether this response is anticipatory like Spiderman's "spidey sense" (or "Peter-tingle" as it was humorously called in the recent *Spider-Man: Far From Home* movie) or whether the Kelpien is consciously aware of the threat first. The best Earth analogy I can think of is the spines of a hedgehog—the hedgehog makes these stand erect, making itself "spikey", when faced with a threat. However, unlike hedgehog spines, Saru's threat ganglia don't serve an obvious defensive function—perhaps they are a means of silently communicating an imminent threat to other nearby Kelpiens? In that regard, they may be functionally more like an alarm call used by social primates or birds.

Kelpiens also have acute senses of smell and vision. Saru is able to smell specific emotions of Michael Burnham in the first episode of season 2. Dogs can do this—in one study published in 2018 in "Animal Cognition", sweat samples were taken from people watching scary vs. not-scary movies, and then the dogs were tested for their reaction to their owner's sweat. Interestingly, the dogs definitely mirrored the owners' stress states. Regarding vision, Saru has a "larger optical window" than humans, presumably meaning he can see into ultraviolet or infrared wavelengths.

Again, this trait is observed in animals on Earth: for example, kestrels can see ultraviolet signals associated with rodent urine to help them find their prey.

Kelpiens also undergo a metamorphosis at a certain age, called the Vahar'ai. The show script incorrectly referred to this as an "evolution," but that is a misuse of the term. Individuals do not evolve: we do not evolve from babies into adults, nor do caterpillars "evolve" into butterflies. I blame Pokemon for reinforcing this term misuse. Nonetheless, pre-metamorphosis Kelpiens are vegetarians, and are observed farming kelp (perhaps the basis for the species name). Post-metamorphosis Kelpiens are more assertive, or possibly even aggressive. We know that these post-metamorphosis Kelpiens acted violently toward another species on Kaminar, the Ba'ul—perhaps they even ate them? Again, this is observed on Earth—frog tadpoles tend to have a primarily plant-based diet, while some adult frogs have primarily animal-based diets.

One especially interesting trait that post-metamorphosis Kelpiens exhibit is the ability to "shoot" spikes at threats. A common misconception is that porcupines do this, but in fact, they can only "shake" off their quills, not shoot them. However, bombardier beetles are far more dramatic in their response to threat—they spray boiling-temperature chemicals at animals that threaten them. While not causing puncture wounds like spikes, they can cause chemical and/or temperature burns and can be fatal to some predators.

Overall, we see a lot of parallels between traits of Kelpiens on Kaminar and various Earth animals. What we have not yet learned is whether there is a direct link between life on the two planets. Are Kelpiens in some distant way related to humans and other Earth-life? Perhaps this question will be addressed in a future season.

# North Carolina Celebrates the 50<sup>th</sup> Anniversary of the Apollo 11 Lunar Landing

By T. Keung Hui

[Editor's note: additional photos are on the [U.S.S. Kitty Hawk web site.](#)]

North Carolina and the rest of the world paused on July 20th to remember the historic 50<sup>th</sup> anniversary of the [Apollo 11](#) moon landing.

The North Carolina Museum of History's One Giant Leap Festival brought seven thousand people to downtown Raleigh to remember the day when man first walked on the moon. Children learned about history and science through a variety of indoor and outdoor activities. More adult-oriented activities included talks about the history of the [Saturn V rocket](#) that launched Apollo 11 into space; what we've learned about the moon since 1969; and what's in store for efforts to take astronauts to Mars. A repeated theme at the festival is that it wasn't a foregone conclusion that Apollo 11 was going to be a success 50 years ago.

"When it was happening, you didn't know if they were going to crash on the moon," said Doug Lively, a member of NASA's Solar System Ambassadors Program. "We didn't know what was going to happen when they landed. It really was life or death right there at that moment."

The nearly seven years between [President John F. Kennedy's famous speech calling for a moon landing](#) and Apollo 11 were a period of major scientific innovations. Everything had to be built from scratch by a team of more than 400,000 people working to ensure the success of the [Apollo program](#).

"None of these were forgone



conclusions at the time," said Tony Rice, a NASA solar ambassador. "None of these systems existed."

The last 50 years has seen significant increases in the amount of knowledge gained about the moon. But in 1969, Lively said, astronauts Neil Armstrong, Buzz Aldrin and Michael Collins "were really heading out into the unknown." Lively said there was a lot of misinformation about the size and mass of the moon. For instance, he said the pictures he saw in a period encyclopedia showed the moon upside down.

A practical example of the lack of knowledge, Lively said, was details about the thickness of the moon's crust. Was the surface just a thin layer of ice? The [lunar lander](#) had big, wide pads so that the landing could be aborted if it started sinking, he said.

"That was really a tense moment," Lively said of Apollo 11's lunar module landing "They didn't know what was going to happen. Were they going to sink into the dust? Were they going to weaken the ice and fall through the ice?"

In addition to its wide pads, the lander was made as light as possible, according to Michael Keefe, a NASA solar ambassador. But contrary to popular belief, he said you could not punch holes through the lander with your bare hand. He said a hole could possibly be punched if you used a screwdriver.

Even after a successful touchdown, albeit with seconds of fuel to spare, the danger wasn't over for the Apollo 11 crew. That's why Armstrong's first order of business after making his giant leap for mankind was to collect

contingency samples, according to Rice. This ensured that they wouldn't be leaving empty-handed should an emergency force them to take off earlier than planned. Despite not being a scientist, Rice said Armstrong collected one of

lander floor. It had been snapped off by a life support backpack in the crowded conditions inside the lunar module. But luckily for the pair, they still had a felt-tip pen.

"They jammed the pen in the fuse module and as soon as they

[Apollo 8](#) served as a precursor to the lunar landings. Rice said that the Apollo program has provided many lessons for a Mars mission. One lesson is sending scientists as part of the crew. The reason he said scientists didn't go up until the final Apollo lunar landing was that engineers were needed on the earlier flights to perfect the untested craft being used. But he said geologists in particular will be needed for the Mars missions to learn more about the Red Planet's history.

Another Apollo lesson for Mars missions is to include a rover for traveling extensive distances. After all, Rice quipped, "Americans sure love to drive." Those astronauts will also need to have the indispensable space tool of duct tape. Rice cited how duct tape saved one group of Apollo astronauts when they used it to fix the fender on their rover to get back to the lunar module before they ran out of power.

"All good astronauts, engineers, and everybody else knows to have duct tape with you," Rice said.

A third Apollo lesson, Rice said, is to "send the robots first." That means sending multiple probes to Mars to get information before astronauts are sent. As an example, he cited the [InSight](#) lander on Mars that NASA is using to get daily weather reports. Rice encouraged people to follow [InSight](#) on Twitter at @MarsWxReport.

Looking ahead to Mars, Rice cited a number of challenges to be solved before crewed missions can be sent. A major challenge is finding the political will, he said, to match the national commitment launched in the 1960s for the Apollo program. It culminated in 400 million to 600 million people watching the Apollo 11 landing on television. But he noted how



the best geological samples taken during the various lunar landings.

Their problems still weren't over as Armstrong and Aldrin prepared to leave the moon. They found the circuit breaker switch for the ascent engine lying on the

did that, the commander in Houston said, "Well, we have a light." Lively said. "So up they went."

NASA has now set its sights on orbiting astronauts around Mars by 2033, similar to how

quickly Americans lost interest in the Apollo missions, aside from the Apollo 13 rescue mission. He said many people he's talked to are surprised that there was more than one lunar landing. Since then, he said there hasn't been a national commitment to go to Mars or return to the moon.

"NASA doesn't decide where NASA goes," Rice said. "Congress decides that."

Aside from the political challenge, Rice said there a variety of scientific challenges to be solved before NASA sends astronauts to Mars. This includes generating enough fuel, dealing with the radiation, and producing enough food. There's also the practical distance issue. He pointed to the 72-foot high Daily Planet globe located at the N.C. Museum of Natural Sciences' Natural Research Center in downtown Raleigh. Based on that scale, he said the moon would be 19 feet tall and located about four blocks away at the intersection of Jones Street and Glenwood Avenue. Mars would be located around Kernersville, between Greensboro and Winston-Salem.

"It is hard to get to Mars," Rice said. "The moon is next door. It is easy to get to it."

With all these challenges, Rice said he believes it will take a global coalition working together to reach Mars.

"It was rah-rah US during the Apollo program," Rice said. "It was the space race. I really don't think that's how things are going to work going to Mars. We're going to need the help of other nations."





# 50th Anniversary of the Moon Landing: A Personal Observation

## By Brad McDonald

I was a space generation child and grew up in the middle of the space race. I witnessed the early [Mercury](#) and [Gemini](#) missions on TV's set up in classrooms or at home whenever they were taking place. My heroes were astronauts and I was envious of their ability to go into space. I read many books; fiction, non-fiction and science fiction so I was hooked! I was also captivated by the various movies and TV shows, especially *Star Trek*. I couldn't believe my luck I was living in the space age!

In June of 1968, I joined the Air Force, took basic training in Texas, attended technical school in Colorado and was finally stationed in Kansas. After being in Kansas for about six months, a major historical event took place, the moon landing.

On the night of the [Apollo 11](#) moon landing, I was fortunate enough to witness it all. At the time, the Air Force divided the 24 hour work day into three shifts, 8am to 4pm, 4pm to 12 midnight and midnight to 8am. My top sergeant knew I was a 'space nut' and let me go early from the first shift so I could witness the big event. The closest TV to our shop/hanger was the enlisted man's club. I wasn't really a drinker and I'm still not, but the club had a TV. Unfortunately, everyone else had the same idea. So I went to our 'day room', a TV lounge in our barracks across the base. It was also crowded but I didn't have to put up with any drunks!

I got there just in time for the 'touch down' which was about three in the afternoon, Wichita, Kansas time. We learned that the walk would take place later, so I

had time for a quick dinner and then back to the day room to claim a seat and waited... It was about ten that night before the actual walk, but I was there. We all watched, mesmerized by the fuzzy image and I remember the CBS news anchor, Walter Cronkite actually teared up. Maybe he was thinking how the mission had beaten the odds. Before the launch the astronauts were given only a 60% chance of success. It's estimated that over a half billion people watched the event. That's the largest TV audience for any event. What's even more amazing was the fact that over a million people had gathered in Florida just to watch the lift off! That event recorded the loudest man made noise since the atomic bombs. (The [Saturn V rocket](#) is still the most powerful rocket ever built.)

The adventure continued and I tried to see all the landings, but it wasn't always possible due to being in the Air Force and unusual work schedules. However, I did have one last Apollo adventure. Just prior to being shipped overseas, I was given a 30-day leave and my family, knowing I was a space nut, decided to take a vacation to Florida and visit Cape Canaveral during a mission... [Apollo 13!](#)

Yes, I know, it wasn't actually a moon landing, but was still an Apollo mission. I saw an amazing launch and toured the facility with the family. All the NASA people were smiling and confident. I was really excited and bought mission patches and many other souvenirs.

Meanwhile, our family went to Daytona Beach for a short stay.

While there, I met some young ladies and we went to see a movie. Yup, it was a science fiction space adventure, called "Marooned." Three astronauts are trapped in an Apollo space capsule and a rescue mission is launched, literally. When the movie was over, we left the theater and found everybody talking about the poor astronauts. After all it was just a movie, people. Nope, it really happened! Apollo 13 was in trouble! My dad suggested cutting the Daytona Beach visit short and we returned to Cape Canaveral. Understandably, it was a totally different experience. Doors were closed, blinds were drawn, few people and fewer smiles.

Fortunately, the crew made it back and, unfortunately, I went to Southeast Asia. My fascination with space was put on hold. We received news but no TV visuals and the Apollo program was cancelled due to budget concerns. At the height of the space program, NASA had 36,000 employees and 360,000 sub-contractors of all types worked on the many aspects of the complex systems.

While all that was going on, *Star Trek* was cancelled as well—at the height of the space age, no less!

There was some good news, though. NASA continued manned missions with [Spacelab](#) and eventually the [Space Shuttle](#). *Star Trek* made a comeback, first as an animated series and then as movies.

One disturbing aspect of the moon landing, which I've never understood, concerns the people who don't believe the landings happened. An estimated 4-6% of

# The Science Behind the Apollo Program

## By Diane Ripollone

US citizens believe it was a hoax. What a shame, to deny one of mankind's greatest achievements. A recent series on National Geographic channel did a great job of debunking the various claims of a faked mission. Of course, people will believe what they want to and don't like being told they are wrong. I actually feel sorry for those people. Not being able to embrace the great achievement, leaves them 'on the outside looking in' and being left out of an amazing part of human history.

The 50<sup>th</sup> anniversary of the landing is being observed in many ways, including here in Raleigh at the N.C. Museum of History. More importantly, there is a new documentary, *Apollo 11*, which will have a limited theatrical release. Also, there are many features on various TV channels.

There is one surprise from the Apollo 11 mission regarding previously undiscovered tapes. They have been in storage since the landings and are nearly pristine recordings of the Apollo 11 mission! The owner paid \$217.77 for what was considered government surplus 2" video tapes. Now Southeby's says they may be auctioned off for as much as \$2 million. WOW!

### APOLLO POSTSCRIPT

Neil Armstrong's quote, "One small step for man; one giant leap for mankind," is actually wrong. The audio feed to Earth missed something and a computer enhancement of the quote reveals it was actually, "One small step for a man; one giant leap for mankind." Armstrong always insisted that's what he said, but agreed you could not hear that on the audio tapes.

I don't know about you, but I actually prefer the 'incorrect' version. What do you think?

Do people really know about the science behind the [Apollo Program](#)? The technology and engineering were achievements that many who were involved still say they can't believe they achieved. But there was something else that was part of the mission and program, planetary science. The astronauts were trained to make geologic observations and collect samples from the lunar surface which they brought back to Earth. The materials and rock brought back from the moon helped scientists understand the Moon's origins and history. It also helped spark future planetary missions like [Voyager 1 and Voyager 2](#).

[Apollo 11](#) stayed on the surface for 2½ hours and, during that time astronauts, set up surface experiments and explored some of the craters in the area. People don't realize not only was Aldrin's boot print photo historically significant, but it also revealed a good deal of information about the lunar surface. To study the surface the early Apollo missions carried a "seismometer and laser ranging retroreflector". The seismometers were brought to the Moon during Apollo [12](#), [14](#), and [15](#). Eventually, the seismometers would detect thousands of moonquakes. Because the seismometers measured ground displacement, scientists could determine how seismic velocities varied on the Moon. This would give them the information needed to understand the Moon's internal structure. That was the basic "stuff," as they say; the more complicated discoveries were the locations of lunar seismic sources and seismic wave characteristics. The Laser Ranging Retroreflector experiment provides the distance between the Earth and the Moon. Laser beams are aimed at the reflectors to calculate this distance. The

experiment is continues to return data, which currently indicates that the Moon is receding from the Earth about 3.8 centimeters a year.

One of the major, and amazing, experiments is that all the Apollo Missions (except for 13) returned a total of 493 Kg of material (regolith) from the Moon. The regolith brought back was analyzed and turned out to be largely basalt, with high concentrations of titanium and familiar minerals found on Earth. Scientists unraveled the history of the Moon from this regolith. Radiometric dating found the basalts aged more than 3.5 billion years old. Besides the regolith sampled, astronauts from later missions brought back materials from ejecta of craters. Here they found impact melted rocks and rare granites. Later missions also investigated the Apennine mountains. At these locations, they looked for rocks showing evidence of uplift. All the missions contributed to the detailed Maps of the Moon we have today.

There were many more experiments: the Lunar Surface Magnetometer that measured the magnetic field of the Moon and a Solar Wind Composition Experiment that allowed solar wind particles to embed on foil. This was then returned to Earth for analysis. So when we think about the Apollo Program, let's think about all the astronauts did for science. They were all trained to do these experiments and brought back a piece of the Moon with them. The surface analysis was extensive and were key to the creating and testing the models of the Moon. But more importantly the lasting scientific effects of Apollo was the push for ongoing exploration of our solar system.

# ***ST:TOS* – “Hades”**

**By Brad McDonald**

## PART II – ACT FOUR

FADE IN:

ACTION IS CONTINUOUS  
FROM ACT THREE

EXT. OLIN - DESERT – MID-  
DAY – ON TEAM

Spock is moving with difficulty,  
assisted by Zana. Udval is  
doing better, but aided by  
Montalva. Each is dirty, weary,  
clothes are stained and torn  
with cuts and scrapes visible.  
Zana and Udval have beards;  
all are sunburned and parched.

ON KIRK AND MCCOY

Kirk tenses and makes a move  
to assist them, but McCoy  
restrains him.

MCCOY

They made it this far,  
Jim. Let them finish on  
their own.

Kirk nods in agreement,  
reluctantly.

WIDE ANGLE – AT FINISH

Team passes under archway at  
marker.

BENEL

They have officially  
completed the challenge.  
However, the two who  
did not —

KIRK

(interrupting)

I'm sending my security  
people to find them.

ON SPOCK

He steps forward, tired and  
barely focused.

SPOCK

One moment, Captain.

(to Benel)

Is there a time limit on  
the challenge?

BENEL (O.C.)

Why, no...

SPOCK

Is it required that we all  
finish at the same time?

BENEL (O.C.)

Again, no, why do you  
ask?

ON KIRK

He picks up on Spock's line of  
thought.

KIRK

Then we'll wait. They  
may still show up.

(uncertain)

Right, Spock?

AS BEFORE – ON SPOCK

SPOCK

Unquestionably, sir.

Spock is about to collapse  
when McCoy approaches him  
and begins scanning.

ON MCCOY

After a few beats, off tricorder:

MCCOY

Jim, Spock has enough  
toxins in him to drop an  
elephant!

NEW ANGLE

MONTALVA

He was bitten by an  
animal like a Gila  
monster.

KIRK

(to Benel)

A small, brightly colored  
lizard.

Benel is shocked and surprised.

BENEL

A corota; it's bite is  
usually lethal.

AS BEFORE – ON MCCOY

MCCOY

Almost was; I need to  
get Spock to the ship,  
Jim.

ANOTHER ANGLE

McCoy turns to Udval and looks  
at his crutch.

MCCOY

(continuing)

What about you?

UDVAL

Just a slight sprain,  
Doctor.

McCoy begins scanning Udval.

MCCOY

(scanning)

Let me be the judge of  
that.

(beat)

Forget the medical  
profession, Mr. Udval.  
You have a hairline  
fracture.

McCoy puts the tricorder away and slings the strap over his shoulder.

MCCOY  
(continuing)

I'll take care of you both on board --

WIDE ANGLE

SPOCK  
(interrupting)

I would prefer to remain until the challenge is concluded.

McCoy turns to Kirk for a 'ruling.'

KIRK  
(concerned)

Can you last that long Spock?

SPOCK  
Without a doubt, Captain.

McCoy begins to protest, loudly.

MCCOY  
But, Spock!

SPOCK  
(to McCoy)  
I trust you can keep me 'awake,' by using one of your noxious concoctions.

Kirk nods to McCoy in approval. McCoy shrugs, takes a hypo from his bag and gives Spock a shot. He then turns to Udval.

ON UDVAL

UDVAL  
If it's all the same to you, Doctor, I'd like to stay, too.

(smiling)  
Can't wait to see how this ends.

NEW ANGLE

McCoy is about to protest when Kirk points to the desert. McCoy turns to see:

MCCOY'S P.O.V.

Four figures are moving from behind a rock formation. We see Coloradas, Lingari, Pilit and a limping N.D. Domai. Pilit has a bandaged shoulder and is in pain.

TWO SHOT – MCCOY AND DENEL

McCoy turns to Benel, sarcastic.

MCCOY  
Since it's your people who seem to need help, may I assist them?

Benel is surprised by McCoy's offer and nods.

WIDE ANGLE

McCoy moves quickly to meet group. Kirk follows and motions security team who surrounds Pilit and N.D. Domai, phasers drawn. McCoy begins scanning injured Domai. Kirk moves to Coloradas and Lingari. Both appear dirty and tired as other team members.

KIRK  
(to Coloradas)  
Report, Commander.

ON COLORADAS

COLORADAS  
Captain, our two 'friends' thought Lingari would

make a good captive, but she had other plans. When I found her, she had them restrained and ready to transport.

ON KIRK

He's smiling broadly and looks at Lingari with admiration and pride.

KIRK  
Well done, Yeoman. How did you manage that?

ON LINGARI

She is a bit embarrassed and subdued.

LINGARI  
I think they mistook me for a 'poor defenseless girl,' Captain.

ON COLORADAS

COLORADAS  
She's being modest sir. They managed to surprise and capture her. Later, when she saw me, she made good use of one of our crude knives, which they never even looked for.

(beat)  
Guess they figured we weren't smart enough to do that. But she got one in the arm and the other in the leg.

(beat)  
The third one got away, but he won't be hard to find, he has an arrow wound.

Coloradas points his own posterior, taps his bow, winks and smiles mischievously.

TWO SHOT – KIRK AND LINGARI

Kirk suppresses a smile.

LINGARI

(apologetic, worried)

Captain? I hope we didn't ruin your plan for a diplomatic solution to our mission.

Kirk is enjoying the moment and puts a hand on her shoulder.

KIRK

Not at all, Yeoman. Speaking of which...

Kirk turns to face Benel.

NEW ANGLE – KIRK, BENEL AND N.D. DOMAI

Kirk indicates the prisoners.

KIRK

(continuing)

This is your idea of not interfering?

BENEL

(embarrassed)

I don't know... what to say. Pilit had no authorization to kidnap --

ON SPOCK

SPOCK

(interrupting)

There were several incidents: Poisoning a water hole, placing a dangerous animal in our camp and then the kidnapping.

(beat)

I believe they were attempting to discourage us by increasing the difficulty of the challenge, incrementally.

(beat)

We were fortunate to have an excellent team, capable of overcoming the obstacles.

ON BENEL

He looks guilty and confesses quietly.

BENEL

(to Kirk)

I must admit, I recommended that you use a team rather than an individual challenge. History has shown that teams don't do as well.

ON KIRK

KIRK

Actually, teamwork makes us stronger, which is why we are part of the Federation.

(smiling)

It's the ultimate team.

AS BEFORE – ON BENEL

BENEL

Pilit and the others will pay for their part in this, I promise.

ON SPOCK

SPOCK

According to our research, I believe you will find the Orions are behind this. Since they could not intimidate your people with force, they tried subterfuge. Chances are the Orions paid Pilit and the others to arrange our difficulties.

NEW ANGLE

McCoy is becoming impatient.

MCCOY

Now that we've settled that, can we get our people back to the ship? I have work to do!

Kirk is mildly amused and nods approval.

KIRK

Okay, Bones, have it your way, for now anyway.

(to Benel)

What about the prisoners?

BENEL

May I borrow your security team while I arrange something?

CLOSE ON KIRK

KIRK

Of course. I'd like to remain so we can start discussions on a trade agreement. I trust you agree that my people did complete the challenge successfully.

ON BENEL

BENEL

Yes, I agree, Captain. Your people are remarkable. No other outsiders have even attempted the challenge.

AS BEFORE – CLOSE ON KIRK

He's surprised by the comment.

KIRK

So you didn't know we couldn't track our team

due to natural interference?

BENEL (O.C.)

No, Captain.

Kirk reacts favorably, then:

KIRK

Very well, I think you'll find the Federation has much to offer and even more to share.

ON SPOCK

SPOCK

For instance, my own world has had a history of water problems. Over the centuries, we have devised a number of solutions. I would be happy to discuss them with you whenever you wish.

ON MONTALVA

MONTALVA

At home, we have not had any rain in over 400 years. We've come up with many ways to deal with it.

ON BENEL

He's surprised and turns to Kirk.

BENEL

I'm somewhat embarrassed. After what has happened, you still wish to help us?

KIRK

Maybe you should consider that at your next council meeting.

NEW ANGLE

Kirk moves off with Benel, prisoners and security team.

Like a mother hen, McCoy gathers the team members for transport. Montalva moves toward Zana.

MONTALVA

(to Zana)

Did you ever come up with that second name for me?

ZANA

Yes, I did; it's 'friend.' Is that okay with you?

Montalva smiles warmly.

MONTALVA

Absolutely!

TWO SHOT - LINGARI AND COLORADAS

LINGARI

Can't wait to get back on board Enterprise. I'm going to drink a gallon of water, then take a shower that will last all day.

Coloradas nudges Lingari and smiles, then speaks in a mock conspirator's tone.

COLORADAS

I'm going to look at the ship records about the bow and arrow Spock said he and the Captain made.

ON MCCOY

McCoy overhears the conversation.

MCCOY

No need to check ship's records, Commander. I was there and it's all true. They worked fairly well, too. After all, we did successfully

complete our mission and even had the heir apparent named after myself and the Captain.

TWO SHOT – SPOCK AND UDVAL

Udval and Spock are standing side by side, listening to McCoy.

UDVAL

(to Spock)

They really named the heir after the Captain and the Doctor, sir?

Spock sighs visibly and turns to Udval.

SPOCK

(irritated)

Unfortunately, yes. The Doctor has been insufferable ever since. It has given him the opinion that he is more important than he actually is.

Udval is amused.

ON MCCOY

He's smiling smugly at Spock's statement.

MCCOY

You wait until I get you in sickbay. You'll find out just how important I really am!

Off McCoy's statement...

FADE OUT.

END OF PART 2 - ACT FOUR

THE END

## Upcoming Events

<b>Aug</b>	<b>3</b>	<b>4 p.m. Ship Meeting</b> <b>Texas Steakhouse, Morrisville</b>
<b>Sep</b>	<b>7</b>	<b>4 p.m. Ship Meeting</b> <b>Texas Steakhouse, Morrisville</b>
	<b>15, 18</b>	<i>Star Trek: The Motion Picture</i> re-released in select theaters
<b>Oct</b>	<b>5</b>	<b>4 p.m. Ship Meeting</b> <b>Texas Steakhouse, Morrisville</b>

**DON'T FORGET TO CHECK YOUR STARFLEET STATUS**

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***THE WRIGHT STUFF***  
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