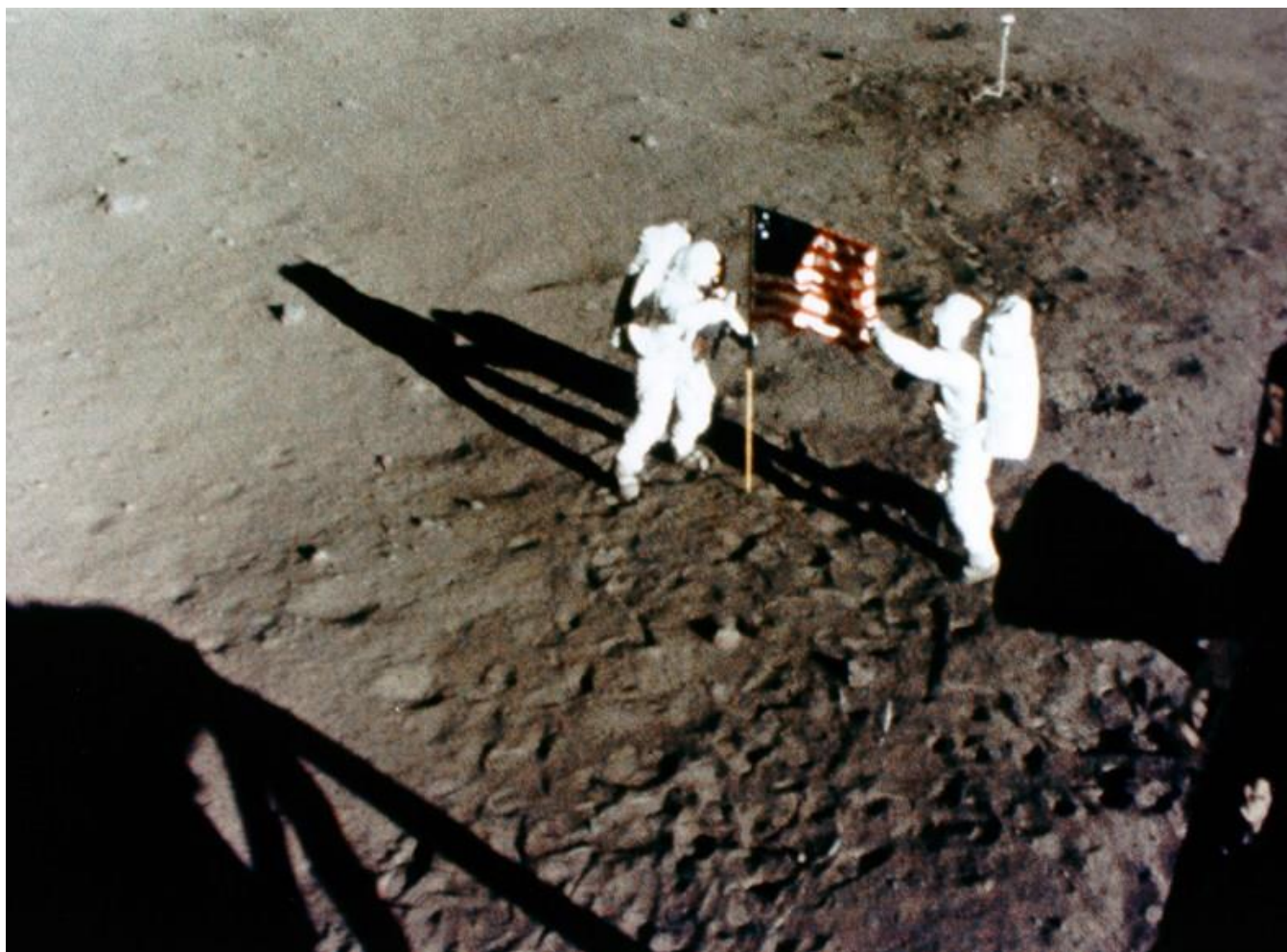


Sky **WAA** *tech*

The Newsletter of Westchester Amateur Astronomers

July 2019



July 20, 1969

Neil Armstrong set foot on the Moon at 10:56:15 pm EDT. At 11:41 pm EDT, Armstrong and Buzz Aldrin set up the American flag. A TV camera, seen at the top edge of the picture, relayed the event to Earth. This is a frame from a 16mm movie camera mounted in the window of the Lunar Excursion Module (the LEM, now officially called the Apollo Lunar Module and abbreviated simply LM, but still pronounced “LEM”) that was run at a slow frame rate to capture events on the surface. NASA image ID #S69-40308.

The next WAA club meeting will be our Members' Night

Friday, September 13th, 7:30 pm

**Lienhard Hall, 3rd floor
Pace University, Pleasantville, NY**

Every September our meeting features our own club members. It's one of the most popular and well-attended meetings of the year.

All WAA members are invited to make a presentation about recent trips, new or restored equipment, celestial observations, imaging or other areas they think might be of interest to members. You can bring a Power-Point file on a thumb drive. It's also a show-and-tell: bring equipment, meteorites or astronomy memorabilia.

If you want a spot on the agenda, please send an email to our Vice President for Programs Pat Mahon at waa-programs@westchesterastronomers.org.

Pre-lecture socializing with fellow WAA members and guests begins at 7:00 pm!

Outreach Announcement: July 26

Location: Onatru Farm Park, Lewisboro.

Date: Friday night, July 26

In association with the Lewisboro Library.

Scopes needed. If you can help, please email: outreach@westchesterastronomers.org

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Call the WAA club hot line at **1-877-456-5778** (toll free) for announcements, star party weather updates, or questions.

WAA prefers to receive inquiries by email to info@westchesterastronomers.org.

Also, don't forget to visit the WAA web site, www.westchesterastronomers.org.

Starway to Heaven

Ward Pound Ridge Reservation, Cross River, NY

June 29 (July 6th make-up date)

July 27 (August 3 make-up date)

August 24 (August 31 make-up date)

New Members

Julie Chernov

White Plains

Renewing Members

Robert Brownell

Peekskill

Donna Cincotta

Yonkers

Charlie Gibson

Scarsdale

John Paladini

Mahopac

James Peale

Bronxville

Arlene Persampieri

Mamaroneck

Lydia Maria Petrosino

Bronxville

Daniel Rosenthal

New York

Pierre-Yves Sonke

Tarrytown

Alan Struth

Irvington

Ernest Wieting

Cortlandt Manor



WAA Members: Contribute to the Newsletter!

Send articles, photos, or observations to waa-newsletter@westchesterastronomers.org

SkyWAArch © Westchester Amateur Astronomers, Inc.

Editor: Larry Faltz

Assistant Editor: Scott Levine

Editor Emeritus: Tom Boustead

ALMANAC For July

Bob Kelly, WAA VP for Field Events



Jul 2



Jul 9



Jul 16



Jul 24



Jul 31

Fifty years ago, a guy spent lots of precious fuel looking for a parking space in the Sea of Tranquility. Fifty years from now, there will likely be a “ParkYour-LEM” app for that. You can see for yourself how it looks from here as the Sun rises over Tranquility Base in the evening of July 7th. Looking on the 8th will show the same sun angle Apollo XI¹ had. The best dates to see all the Apollo landing sites are the 11th through the 13th in the evening and 21st and 22nd in the morning.

Summer nights are short nights and there are many things we can't see from here. On the 2nd, a total solar eclipse slashes across the South Pacific and cuts a 125-mile-wide strip of darkness across Chile and Argentina. The path misses Buenos Aires by 20 miles with the Sun one degree above the horizon. July 16th has a partial lunar eclipse visible from most of the world. It won't be visible in the US, except that the end of the penumbral phase will be visible at Nantucket for two and three-quarter minutes at Moon-rise, and for just three minutes in far eastern Maine. It won't be really noticeable, but I include it for completeness. That same full Moon eclipses Saturn and, later in the day and Pluto for some observers in the Southern Hemisphere, but not during the lunar eclipse.

Here's the most incredible thing we won't see – Venus passes behind our Moon on July 31st for much of the USA. The pair will be five degrees to the lower left of the Sun in the late afternoon our time. The Moon will be so close to the Sun as to be invisible. The Sun will be moving in the direction of the Moon and Venus as seen from our point of view, making this a dangerous observation.

Oh, the things you *can* see! During the 4th of July fireworks point out the two-day-old Moon low in the west-northwest. Mercury, Mars, Pollux and Castor will be hiding a few degrees above the horizon to our Moon's lower right. Is it possible to see these objects, even with binoculars? Is it possible to see the Beehive Cluster between the Moon and Mars? Maybe and I doubt it, respectively. Farther up to the left, Leo will

be diving toward the Moon. Jupiter will be easy to sight in the southeastern sector of the evening sky with Saturn just rising to its lower left. Which will be the first stars to come out that night? Perhaps Arcturus almost overhead, then Vega and Deneb in the east? That afternoon, we'll be at aphelion for the year. At 94,513,221 miles away from the Sun, we'll be just over 3 million miles farther than we were at perihelion in January. Mars will be about as far away from us as it can get, at 238,700,000 miles. Mercury is a bit more than half the Sun's distance from us at 53,600,000. Mercury and Mars are both near aphelion, Mercury on the 7th and Mars in late August.

The four inner planets are swallowed up in the Sun's glare by mid-month. Mercury passes between the Earth and Sun on the 21st, but not directly in front of the Sun – that transit of the Sun will happen on the planet's next pass on November 11th. The SOHO satellite's C3 camera² will show Mercury giving the Sun a wide berth five degrees to the south from the 17th through the 25th. Mars appears as if it is resisting the Sun's attempts to make it hard to see, slowly following Mercury into the glare. Careful observers may get a glimpse of a large crescent Mercury as the planet's appearance swells to one-quarter of the apparent size of Jupiter.

Venus has had a long run in the morning sky and similarly will crawl past the Sun. The brightest planet will spend two months in the C3's field of view, starting July 16th.

Now, Jupiter gets up where we can see it, highest by 11:30 PM on the 1st and during twilight by the end of the month. Don't worry. Jupiter's features can stand up to our summer twilight skies. Watch for Jupiter's Great Red Spot unraveling. Will it come undone?

Saturn rises at sunset at its closest approach on the 9th. Its shape is obvious with optical aid. Later at night, high power in steady skies will make the ringed planet a joy to see. Iapetus is brightest this month, farthest to the west (ahead) of Saturn on the 15th. Pluto is two degrees southeast of Saturn. We are also

¹ Back in ancient times, we numbered space missions with Roman numerals. That led to typesetting errors in newspapers like “Apollo II” or “Apollo X1”. Your editor will use Arabic numerals in SkyWAArch.

² Current Solar and Heliospheric Observatory images are at <https://sohowww.nascom.nasa.gov/data/realtime-images.html>

closest to Pluto this month, on the 14th. But Pluto is 4,000,000 times fainter than Saturn at magnitude 14.2.

After true darkness, around 10:30 PM, the Milky Way is back, arcing across the eastern sky, with the center of the galaxy between and just below this month's Guardians of the Galaxy, Jupiter and Saturn.

The Manhattanhenge solar lineup with the cross

streets of Manhattan happens again on the 12th and 13th.

The International Space Station returns to the morning skies in the first half of the month. It pulls some all-nighters, visible every 93 minutes, from around the 15th through the 21st. It sails across the evening sky for the remainder of the month. ■

First Flight, First Landing

Bob Kelly

The first powered manned flight at Kitty Hawk was followed 66 years later by a manned landing on Earth's Moon. My first powered flight was at age 13, the week of the Apollo 11 Moon landing. That week combined the extremes of my passion for anything that flew in the air or in space. My grandparents invited me to take a commercial airline trip to Cincinnati, Ohio to visit my cousins – eight boys. On the evening of Sunday, July 20th, we gathered around the TV. Armed with maps and timetables from the New York Times, I watched (well, listened, no video from the spacecraft) as Armstrong and Aldrin worked to set down the Lunar Module.

CBS had a night of music and song about the Moon planned while the crew took a planned rest period. Then, word came the crew was going to skip that rest and move right to the EVA. I imagined the astronauts, like me on a Christmas Eve, too excited to sleep. It took a while, but at 10:56pm ET there was "One small step" onto the lunar surface. I used my Brownie Kodak camera on the 'flash' setting, without the flash, to take two photos off the TV screen. Ko-

dak didn't print them, but there was some impression on the negative. We watched the ghost-like figures hop across the Moon and stop to listen to President Nixon. As midnight approached, my cousins drifted off to bed. The excitement of the day, and the fuzziness of the picture, caught up with me and I went off to bed myself.

With the optimism of youth and Werner von Braun's plans, I was sure we were going to colonize space in my lifetime. My college friends wanted to go to Europe; I wanted to orbit the Earth. Looking at the sky led to studying meteorology, and an EPA grant led to a career improving air quality on Earth. I wasn't going to be one of the few who have explored space, but my passion for human and robotic exploration of space still burns. I even calculated that my son, a U.S. Marine, might be on the long-hoped-for first trip to Mars.

We cut short the exploration of our Moon to save \$35 million dollars. In 50 years, we haven't been back. It shows how hard it was to do then. They were ahead of their time. I'm still a 13-year-old. ■



Karen Seiter and husband George Carteris with Buzz Aldrin at the 2009 Cradle of Aviation Museum gala. Behind them is the Lunar Module that was slated for the canceled Apollo 18 mission, on permanent display at the museum. An oncologist, long-time member of WAA and former Membership VP, Karen is a member of the Board of Directors of the Cradle of Aviation Museum in Garden City, LI, and is now its Secretary. She observes with a Meade LX-90 8" SCT.

WAA Member Profile: Larry Bassett

Home Town: Thornwood, NY

Family: Married: two adult daughters and two adult sons.

Genesis of Interest in Astronomy:

Thanks to the NYC school system my interest was kindled at the age of 8 on a day in 1940 when my third grade class walked from PS 91 on Amsterdam Avenue and 91st Street in Manhattan to the Museum of Natural History and the Hayden Planetarium. The fascination of touching meteorites and the display of the solar system in the auditorium [the famous Copernican Room—Ed.] were spellbinding and after the planetarium show in the Hayden dome there was a new dimension to my life.



First Look Through a Telescope: At the age of 11 or 12 at a sleep away camp a counselor brought what I now believe must have been 10" reflector and I saw the planet Saturn and it's rings. A WOW moment. I already was an avid reader of science fiction and stories of travel to the planets. That experience was so vivid that I remember it as clear as the day it occurred.

Favorite Objects to View: Solar system planets and "clear" views of galaxies showing their spiral rings. Objects that stimulate imagination and dreams.

Equipment: This is a story in itself. As a teen I attended meetings of the American Astronomical Association on the fifth floor of the museum (incredibly, during the 1940s, there still were meetings to address what the so-called "canals" on Mars actually might be!) I learned about a telescope making class that met in the planetarium basement workshop. For weeks, while the rest of America was watching Milton Berle on Tuesday nights, I ground a six inch parabolic mirror for what was to be a telescope. Sadly, telescopes in those days were completely different from the new designs of today and that mirror stayed wrapped in tissue paper for about 70 years. Then, I met Francis O'Reilly [a former WAA president-Ed.]. Finally, my mirror was going to have astronomical home. Francis and his colleagues at Stellafane completed a hand crafted Dobsonian and, finally, I no longer had to depend only on others.

What equipment would I like to Own? Unfortunately, it probably won't happen, but any telescope with a fully GoTo system.

Current Interests: With all that is taking place in the world of astronomy I just enjoy the almost daily news of new discoveries. The one thing that really interests me is the search for life somewhere in the cosmos. Perhaps I'm a cynic but I am eager to learn how religion will react and "explain."

Special Trips: Sadly, I have not yet witnessed a solar eclipse but I'm hopeful for April 8, 2024. What I have experienced are marvelous views of the Northern Lights. While visiting in Northern Maine I have lain on my back in open fields to witness extraordinary views of the shifting colors of the auroras flashing across the sky. Photographs do not come close to communicating the phenomenon.

My Career: After leaving the army (Korean "Conflict") I had a number of management jobs till I became a management consultant in 1967 and though I might be considered to be retired I still have a few clients after these more than 50 years. Consultants never die, they just run out of clients.

WAA Membership: My daughter Wendy, who many members know, and I attended NEAF a number of years ago and, just to show how important having a booth at the show is, we discovered the group and signed up.

A Few Additional Thoughts: As a tour guide at the American Museum of Natural History, including the Rose Center for Earth and Space since 1997, I have a unique opportunity to educate the public and, in doing so, help destroy myths, distortions and conspiracy theories about the environment and the nature of science in today's world. Most of all, it gives me a forum to share with museum visitors from the US and the far reaches of the world the mysteries of the cosmos and instill in them an understanding of the state of humanity and the environment in our global village. Hopefully, at the end of the tours visitors leave with an anticipation of future discoveries as astronomers and scientists expand our knowledge of the universe. ■



A Reminiscence of July 20, 1969

Eva Andersen

On July 20, 1969 I was 14 years old and finally had my first job that wasn't babysitting my five younger siblings. I was working at a diner very popular with locals and tourists. I made \$1.00 an hour plus tips. Even though I had to be on duty most days at 6am to serve breakfast to fishermen, golfers and hikers it was good money and I loved waitressing.

That particular day I was home in time to see the Apollo 11 Lunar Module Eagle land on the Moon. It was beyond anything I could have ever imagined. Growing up in the Adirondacks gave me countless opportunities to stare up at black skies, learn the constellations and watch auroras shimmer in sub-zero winter darkness. My fascination with astronomy began at an early age and like so many youngsters I spent much of my time looking up at the Moon and wondering if anyone would ever go there and come back alive. I often became sad thinking about Laika the dog and Albert II the monkey who were shot into space but never made it back to earth.

I spent the rest of that day doing chores and waiting for the moment when a human being would actually stand on the Moon. I assumed the other seven members of my family would stay up with me but one by one they all went to bed. I was sitting in the living room with only the blue glow of the TV screen as a light source listening to Walter Cronkite discuss the hazards of all that had happened the past few days and the many dangers still to come. I remember being excited but also nervous that something bad would occur.

Suddenly our back door flew open (we didn't lock it in those days) and my neighbor (we'll call her Diane) ran in sobbing and in a very low voice said, "Get your Dad. My husband has a gun and he's going to kill me." I was speechless for a few moments because my neighbor had blood coming from her nose, red marks on her face and neck and her clothes were torn. Before I could run down the hallway to get my Dad, he and my Mom were headed in our direction pulling on various articles of clothing as they came into the living room. Now Diane started to shout and beg for help saying her husband (let's call him Jack) had been drinking, was angry and had become violent. Diane's fear was that he was going to hurt her young son from

her previous marriage who was still in the house. My mother wisely forbade my father from going into the neighbor's house (he was wisely in agreement) so they called the police. At that time our town had operator-assisted calling. Much to our dismay the head operator (let's call her Emma) was on duty and she was famous for repeating everything she heard over the switchboard.

My mother told her we needed help right away for a domestic situation. My grandparents were the first to arrive on scene, neither of whom had been called but there they were, in pajamas and overcoats and my grandmother carrying an apple pie. They heard there might be an altercation between my parents and got there as soon as they could. Emma was my grandmother's BFF.

Now my Dad was outside, behind a corner of our house talking to Jack across the driveway in firm but kind words, trying to get him to put away the gun and come over for coffee. My father was extremely safety conscious; he built our family home as a single-story cement block structure so if there was ever a fire we could all jump out the windows and not get hurt. I don't think he planned to make it bullet proof, but it probably was. My mother cleared us from the living room which had two big picture windows (and the TV) in case Jack really went nuts. The only response from Jack was a series of loud noises made by household items being thrown through the windows of the sunporch. It wasn't safe for us to look but Dad said he saw chairs, dinner plates and a TV laying on the lawn. Aside from being upset by the sheer force of Jack's drunken rage and all the bad stuff that was happening I was also upset because we were missing coverage of America winning the space race.

The local police chief pulled his patrol car into our driveway; it was identical to the one Broderick Crawford drove on "Highway Patrol." No siren, but I remember the red roof light shining off all the broken glass on the lawn. By the time the state troopers arrived from the Barneveld barracks 45 minutes to the south, Chief had the shotgun secured and Jack standing at attention in the yard. Diane was escorted by my parents into the back of the house to get her son, who thankfully had been asleep.

We began to notice more traffic than usual on our rural road-- cars slowing down to get a good look to see if my Mom and Dad were having a dust-off. No doubt Emma was making a few calls of her own.

At some point it felt like the worst was over. The troopers were en route to the Herkimer County Jail with Jack asleep in the back seat. Diane was on our couch wearing one of my mother's sweatshirts, holding a washcloth full of ice cubes to her head and her face. The little boy was under a blanket sleeping next to her. My grandparents were still in their overcoats now serving pie and Sanka to the police chief. My parents were in the kitchen talking in low tones. I found out years later my father wanted to find a way to get enough money to buy the house (Jack and Diane were renters) so he could "burn it to the ground."

Eventually I found the nerve to turn the TV back on. Both astronauts were already on the Moon hopping around and quickly doing the things that had to be done before their oxygen ran out. I was mad that I missed the first steps on the Moon but it didn't last long. At 14, it started to dawn on me this was my first time witnessing domestic abuse and gun violence (my parents didn't do these things). I knew the six of us kids were very lucky. It got better from there: I was no longer watching Apollo 11 make history by myself. I was in the safety of our cement block house, eating pie and no one had been shot. Next to me was our exhausted and battered neighbor who was still alive and next to her was her son who thankfully slept through the worst of the tirade.

Still on their feet, offering comfort in the form of home baked pie and cute stories, were my tired but compassionate grandparents. Sitting down and appearing a little bit relaxed was the police chief, a master of experience and control. Last, but never least, were my kind and honorable parents who led by example. Conversations eventually rekindled and we all sat for a long time talking back and forth, watching brave astronauts, brilliant scientists, confident engineers and dedicated reporters make history.

A few hours later my Dad drove me to the diner. I was so tired I felt sick. In the daylight we saw big piles of broken glass, smashed appliances and personal items strewn about the yard. I think every porch window was broken. It was an awful sight.

At the diner the conversation that morning was not of the Moon landing but whether the commotion the night before that had required two police forces had

been between my parents or between Jack and Diane. Some folks heard both versions. I set it straight.

Dad picked me up in the afternoon and brought me home. He told me how Diane felt bad about things and drove 1½ hours to the jail to post bail and another 1½ hours to bring Jack home. My Mom said our neighbors spent the rest of the day with snow shovels scooping the broken glass and busted furniture into Jack's truck. They raked the lawn several times to get the glass shards off the lawn. After multiple trips to the dump they were sitting at their picnic table, the only intact piece of furniture left, holding hands and eating hotdogs.

Prior to the Apollo flights there were years of training missions and many training-related deaths of NASA personnel. The first officially listed "Death associated with US space programs" was Theodore Freeman on 31 October 1964. He was a U.S. Air Force officer, test pilot, NASA astronaut and an aeronautical engineer. He was killed after his T-38 jet struck a snow goose. The impact caused pieces of the canopy to enter both engines. He ejected but was too low for his parachute to open.

Sadly many of us are old enough to recall the deaths of the astronauts of the Apollo 1 ground mission when fire engulfed their pressurized, pure-oxygen cabin. I still can see the images of the Space Shuttle Challenger engulfed in smoke and flames shortly after lift-off during a cold launch on January 26, 1986. All 7 crew members were killed. Another Space Shuttle in the US fleet, the Columbia, disintegrated on February 1, 2003 upon reentry at the end of its 28th mission, killing the crew of seven and strewn their remains across several southern states.

Fifty years later I can't think of Apollo 11 without recalling the fracas next door to my childhood home. I can't enjoy the exhilarating successes in the space program without still brooding about the catastrophic failures and loss of life as a result of NASA's failure to prioritize and communicate potential for grave harm. The investigations into the Challenger (Rogers Commission) and seventeen years later, the Columbia (CAIB) shuttle disasters were remarkable in that both demonstrated ongoing organizational and culturally flawed decision making and risk assessment processes. These led to negative consequences which forever altered the future of individuals, families and our nation.

Fifty years later I realize despite phenomenal accomplishments in science, technology, transportation, civil rights, medicine, etc. we as a nation still remain organizationally and culturally flawed in our decision making and risk assessment processes. Think substance abuse, domestic violence and gun violence. We still fail to prioritize and communicate potential for grave harm. Think about sub-prime mortgages, Purdue pharma and Boeing 737 MAX.

As an adult I realize relationships are complex as is the burden of leadership and administration at every

level. Here's hoping the next 50 years advances us carefully to our space exploration goals and more importantly to a more caring, thinking planet which comes together to find the solutions to our most dire tribulations.

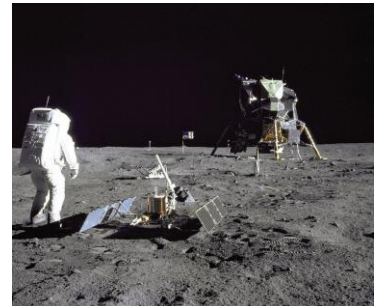
Seriously, we can do this. We put people on the Moon, built a space station that has been occupied since 2000, put rovers on Mars, made a three billion mile trip to Pluto, landed a probe on an asteroid, launched the Hubble Space Telescope and grew lettuce in the ISS... We can do this. ■

The Moon as the Apollo 11 Crew Saw It

Robin Stuart



The NASA photograph on the left shows the Moon from above a point between Mare Crisium and Mare Fecunditatis. It was taken by the Apollo 11 astronauts on 22 July, 1969 as they began their homeward journey. This view can never be seen directly from Earth. The image on the right was taken from Valhalla, New York on 11 June, 2019. It is a single frame made at prime focus through a 70mm f/6.9 Televue Pronto refractor using a Canon 60Da DSLR camera with a 1/400 second exposure at ISO 1000. Using original code written in Mathematica, the image was mapped onto the surface of a sphere in 3 dimensions and from there this perspective view was generated. It simulates what would be seen by an observer located 8,000 km from Moon's center. (Robin Stuart. 2019) ■



President John F. Kennedy's Address at Rice University, Sept. 12, 1962

On April 12, 1961, Yuri Gagarin became the first person to travel in space. Three weeks later American Alan Shepherd made a 15-minute suborbital flight. It would not be until February 20, 1962 that John Glenn's would make the first US orbital flight. Just 3 weeks after Shepherd's mission, on May 25, 1961, President Kennedy addressed Congress, saying that the U.S. "should commit itself to achieving the goal, before this decade is out, of landing a man on the Moon and returning him safely to the Earth." There was not a huge groundswell of public interest: a Gallup poll indicated a majority of Americans did not support this goal. Nevertheless, the US space program began to grow. The following year, Kennedy travelled to Texas to inspect the new Manned Spacecraft Center in Houston. He addressed a crowd of about 40,000 people in the Rice University football stadium. Kennedy's speech was written by Ted Sorenson, with Kennedy making a number of editorial changes. It was given on a typically hot and humid late summer day.

From this speech we generally hear only the famous lines "We choose to go to the Moon. We choose to go to the Moon in this decade and do the other things, not because they are easy, but because they are hard." The speech has a great deal of depth and reasoning behind it, some gentle humor, and it reminds us of the international military, political and moral context in which the space race was playing out. It recalls a time when our leaders were eloquent. I think WAA members will find it interesting. Ed.



President Pitzer, Mr. Vice President, Governor, Congressman Thomas, Senator Wiley, and Congressman

Miller, Mr. Webb, Mr. Bell, scientists, distinguished guests, and ladies and gentlemen:

I appreciate your president having made me an honorary visiting professor, and I will assure you that my first lecture will be very brief.

I am delighted to be here, and I'm particularly delighted to be here on this occasion.

We meet at a college noted for knowledge, in a city noted for progress, in a State noted for strength, and we stand in need of all three, for we meet in an hour of change and challenge, in a decade of hope and fear, in an age of both knowledge and ignorance. The greater our knowledge increases, the greater our ignorance unfolds.

Despite the striking fact that most of the scientists that the world has ever known are alive and working today, despite the fact that this Nation's own scientific manpower is doubling every 12 years in a rate of growth more than three times that of our population as a whole, despite that, the vast stretches of the unknown and the unanswered and the unfinished still far outstrip our collective comprehension.

No man can fully grasp how far and how fast we have come, but condense, if you will, the 50,000 years of man's recorded history in a time span of but a half-century. Stated in these terms, we know very little about the first 40 years, except at the end of them advanced man had learned to use the skins of animals to cover them. Then about 10 years ago, under this standard, man emerged from his caves to construct other kinds of shelter. Only five years ago man learned to write and use a cart with wheels. Christianity began less than two years ago. The printing press came this year, and then less than two months ago, during this whole 50-year span of human history, the steam engine provided a new source of power.

Newton explored the meaning of gravity. Last month electric lights and telephones and automobiles and airplanes became available. Only last week did we develop penicillin and television and nuclear power, and now if America's new spacecraft succeeds in reaching Venus, we will have literally reached the stars before midnight tonight.

This is a breathtaking pace, and such a pace cannot help but create new ills as it dispels old, new ignorance, new problems, new dangers. Surely the opening

vistas of space promise high costs and hardships, as well as high reward.

So it is not surprising that some would have us stay where we are a little longer to rest, to wait. But this city of Houston, this State of Texas, this country of the United States was not built by those who waited and rested and wished to look behind them. This country was conquered by those who moved forward--and so will space.

William Bradford, speaking in 1630 of the founding of the Plymouth Bay Colony, said that all great and honorable actions are accompanied with great difficulties, and both must be enterprised and overcome with answerable courage.

If this capsule history of our progress teaches us anything, it is that man, in his quest for knowledge and progress, is determined and cannot be deterred. The exploration of space will go ahead, whether we join in it or not, and it is one of the great adventures of all time, and no nation which expects to be the leader of other nations can expect to stay behind in the race for space.

Those who came before us made certain that this country rode the first waves of the industrial revolutions, the first waves of modern invention, and the first wave of nuclear power, and this generation does not intend to founder in the backwash of the coming age of space. We mean to be a part of it--we mean to lead it. For the eyes of the world now look into space, to the Moon and to the planets beyond, and we have vowed that we shall not see it governed by a hostile flag of conquest, but by a banner of freedom and peace. We have vowed that we shall not see space filled with weapons of mass destruction, but with instruments of knowledge and understanding.

Yet the vows of this Nation can only be fulfilled if we in this Nation are first, and, therefore, we intend to be first. In short, our leadership in science and in industry, our hopes for peace and security, our obligations to ourselves as well as others, all require us to make this effort, to solve these mysteries, to solve them for the good of all men, and to become the world's leading space-faring nation.

We set sail on this new sea because there is new knowledge to be gained, and new rights to be won, and they must be won and used for the progress of all people. For space science, like nuclear science and all technology, has no conscience of its own. Whether it will become a force for good or ill depends on man,

and only if the United States occupies a position of pre-eminence can we help decide whether this new ocean will be a sea of peace or a new terrifying theater of war. I do not say that we should or will go unprotected against the hostile misuse of space any more than we go unprotected against the hostile use of land or sea, but I do say that space can be explored and mastered without feeding the fires of war, without repeating the mistakes that man has made in extending his writ around this globe of ours.

There is no strife, no prejudice, no national conflict in outer space as yet. Its hazards are hostile to us all. Its conquest deserves the best of all mankind, and its opportunity for peaceful cooperation many never come again. But why, some say, the Moon? Why choose this as our goal? And they may well ask why climb the highest mountain? Why, 35 years ago, fly the Atlantic? Why does Rice play Texas?

We choose to go to the Moon. We choose to go to the Moon in this decade and do the other things, not because they are easy, but because they are hard, because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one which we intend to win, and the others, too.

It is for these reasons that I regard the decision last year to shift our efforts in space from low to high gear as among the most important decisions that will be made during my incumbency in the office of the Presidency.

In the last 24 hours we have seen facilities now being created for the greatest and most complex exploration in man's history. We have felt the ground shake and the air shattered by the testing of a Saturn C-1 booster rocket, many times as powerful as the Atlas which launched John Glenn, generating power equivalent to 10,000 automobiles with their accelerators on the floor. We have seen the site where the F-1 rocket engines, each one as powerful as all eight engines of the Saturn combined, will be clustered together to make the advanced Saturn missile, assembled in a new building to be built at Cape Canaveral as tall as a 48 story structure, as wide as a city block, and as long as two lengths of this field.

Within these last 19 months at least 45 satellites have circled the earth. Some 40 of them were "made in the United States of America" and they were far more

sophisticated and supplied far more knowledge to the people of the world than those of the Soviet Union.

The Mariner spacecraft now on its way to Venus is the most intricate instrument in the history of space science. The accuracy of that shot is comparable to firing a missile from Cape Canaveral and dropping it in this stadium between the 40-yard lines.

Transit satellites are helping our ships at sea to steer a safer course. Tiros satellites have given us unprecedented warnings of hurricanes and storms, and will do the same for forest fires and icebergs.

We have had our failures, but so have others, even if they do not admit them. And they may be less public.

To be sure, we are behind, and will be behind for some time in manned flight. But we do not intend to stay behind, and in this decade, we shall make up and move ahead.

The growth of our science and education will be enriched by new knowledge of our universe and environment, by new techniques of learning and mapping and observation, by new tools and computers for industry, medicine, the home as well as the school. Technical institutions, such as Rice, will reap the harvest of these gains.

And finally, the space effort itself, while still in its infancy, has already created a great number of new companies, and tens of thousands of new jobs. Space and related industries are generating new demands in investment and skilled personnel, and this city and this State, and this region, will share greatly in this growth. What was once the furthest outpost on the old frontier of the West will be the furthest outpost on the new frontier of science and space. Houston, your City of Houston, with its Manned Spacecraft Center, will become the heart of a large scientific and engineering community. During the next 5 years the National Aeronautics and Space Administration expects to double the number of scientists and engineers in this area, to increase its outlays for salaries and expenses to \$60 million a year; to invest some \$200 million in plant and laboratory facilities; and to direct or contract for new space efforts over \$1 billion from this Center in this City.

To be sure, all this costs us all a good deal of money. This year's space budget is three times what it was in January 1961, and it is greater than the space budget of the previous eight years combined. That budget now stands at \$5,400 million a year--a staggering sum, though somewhat less than we pay for cigarettes

and cigars every year. Space expenditures will soon rise some more, from 40 cents per person per week to more than 50 cents a week for every man, woman and child in the United States, for we have given this program a high national priority--even though I realize that this is in some measure an act of faith and vision, for we do not now know what benefits await us.

But if I were to say, my fellow citizens, that we shall send to the Moon, 240,000 miles away from the control station in Houston, a giant rocket more than 300 feet tall, the length of this football field, made of new metal alloys, some of which have not yet been invented, capable of standing heat and stresses several times more than have ever been experienced, fitted together with a precision better than the finest watch, carrying all the equipment needed for propulsion, guidance, control, communications, food and survival, on an untried mission, to an unknown celestial body, and then return it safely to earth, re-entering the atmosphere at speeds of over 25,000 miles per hour, causing heat about half that of the temperature of the sun--almost as hot as it is here today--and do all this, and do it right, and do it first before this decade is out--then we must be bold.

I'm the one who is doing all the work, so we just want you to stay cool for a minute. [laughter]

However, I think we're going to do it, and I think that we must pay what needs to be paid. I don't think we ought to waste any money, but I think we ought to do the job. And this will be done in the decade of the sixties. It may be done while some of you are still here at school at this college and university. It will be done during the term of office of some of the people who sit here on this platform. But it will be done. And it will be done before the end of this decade.

I am delighted that this university is playing a part in putting a man on the Moon as part of a great national effort of the United States of America.

Many years ago the great British explorer George Mallory, who was to die on Mount Everest, was asked why did he want to climb it. He said, "Because it is there."

Well, space is there, and we're going to climb it, and the Moon and the planets are there, and new hopes for knowledge and peace are there. And, therefore, as we set sail we ask God's blessing on the most hazardous and dangerous and greatest adventure on which man has ever embarked.

Thank you. ■

In the Naked Eye Sky: July 2019: A Synodic Anniversary

By Scott Levine

One of my favorite small traditions is to remember the phase the Moon was in the night of an important moment, and then find that phase when the anniversary comes around again. I get invited to lots of parties. I know how the Moon looked the day I was married (just past new), and the nights both of my kids were born (waning gibbous and first quarter). Since we're all connected to the Moon's comings and goings, it's a fun way to reminisce about those times, with the sky more or less the same shape it was in on the big day.

I'm too young to remember the Apollo program firsthand, but I can still remember sitting on my living room floor surrounded by star charts, with 3-2-1 Contact on TV, as I tried to figure out what the Moon looked like the night Apollo 11 landed. Even then, with the landing less than 15 years earlier and much brighter in collective memory, I thought it would be fun to look up at a hazy July sky and find the same phase the Moon was in the night Armstrong and Aldrin stepped off the ladder.

If you were fortunate enough to look up and wave on the night July 21, 1969, you'd have seen the just-about-first-quarter-Moon in Virgo. The bright star Spica (α Vir) was above and 250 light years behind it; an accent mark emphasizing that night.

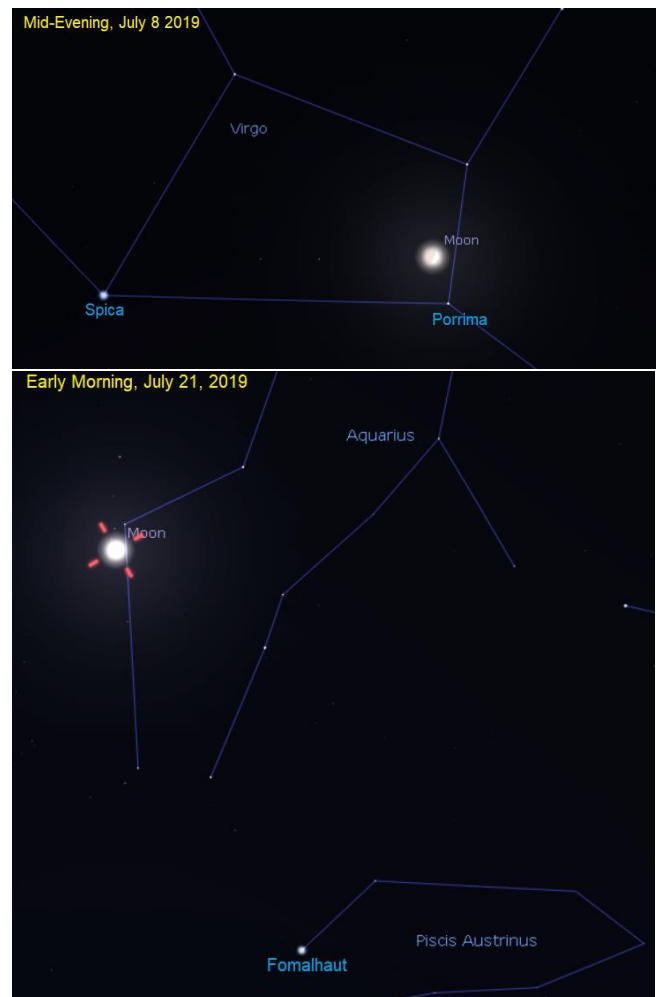
Since synodic months – the amount of time it takes for the Moon go from a given phase back to that same phase – is about 29.5 days, our calendar months quickly fall out of sync with the Moon's phases. This July, the Moon will be at first quarter on July 8.

Rather than Spica, the Moon will be near the off-brand Porrima (γ Vir). Porrima is a double star about 38 light years away that looks like a single third-magnitude star. It's one of the few signposts along the way from Denebola (β Leo) to Spica that we can see through our local light pollution. It's about halfway between the two, in what looks like an otherwise muddy stretch of sky.

With the Moon at the same phase as it was that night, it's not hard to try to imagine what it must have been like to be there. I can imagine the coverage on TV and even wonder how the astronauts felt looking up at a last-quarter Earth rotating silently among the stars of Pisces.

If you prefer to look at the Moon on Eagle's non-synodic 50th anniversary, it will be a waning gibbous on July 20, about halfway between full and last quarter. These phases rise late, around midnight. When it does, you'll see it in the tranquil sea of the sky's watery constellations, among the dim stars of Aquarius. The nearest bright star is first-magnitude Fomalhaut (α PsA), the brightest in Piscis Austrinus. It's never higher than about 20 degrees above the horizon in Westchester's skies, so it can be a fun star to try to hunt down if you're up that late.

These lunar anniversaries give us two chances to remember great moments. Here's a chance to take a second look. Happy anniversary, and clear skies! ■



Scott Levine's astronomy blog, *Scott's Skywatch*, can be found at <https://scottastronomy.wordpress.com/>

Reflections on the 50th Anniversary of Apollo 11

Larry Faltz

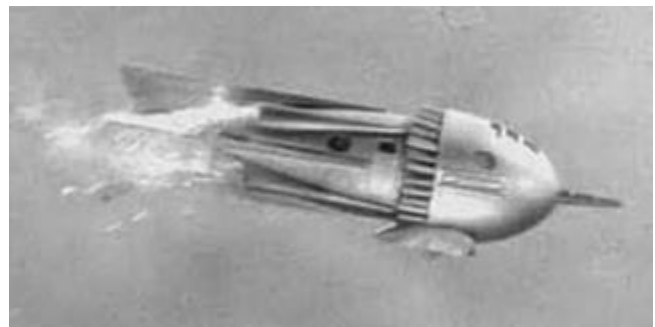
There's one obvious, unavoidable, terrifying thought about the 50th anniversary of the Apollo 11 Moon landing: *I'm old!*

Although as amateur astronomers we think about and look at the Moon all the time, this special anniversary made memories flow, like the taste of Proust's madeleines. I was 21 in that glorious year of 1969, old enough to feel capable, young enough to retain flashes of invulnerability. The year started with Joe Namath and the underdog NY Jets winning Superbowl III and was climaxed by a free ticket (for a really good seat) to the Thanksgiving night concert of the Rolling Stones at Madison Square Garden. In between, there was the great pennant run and World Series win of the Mets, rock concerts at the Fillmore East and Woodstock, which I attended with my then-girlfriend Michelle, who lived in the apartment across the airshaft from that summer's tenement abode on West 104th Street. We lasted from the opening until about 11 am the next morning, when, soaked, tired, hungry and dirty we made the long trek to the car and headed back to the city for a shower and food. But we had been there.

After my first year at the NYU School of Medicine I got a summer job working as a lab assistant for a biochemistry professor. His research interest was the structure of a particular enzyme involved in photosynthesis. Once a week I walked over to a green grocer on Second Avenue and 32nd Street and carried a bushel of fresh spinach leaves back to a sub-basement laboratory. Some of NYU Medical Center, on First Avenue between 30th and 34th Streets, was built on landfill that replaced the original Kip's Bay, where 4,000 British troops had landed on September 15, 1776, a tactical move that forced Washington's army to retreat to Harlem. The lab was in the most subterranean part of the research building, isolated and damp. It was used by Severo Ochoa, from whom I learned molecular genetics. He won the 1959 Nobel Prize for elucidating the synthesis of RNA. The great man wasn't around that summer, but I had the company of a tribe of unnaturally gigantic cockroaches, some of them four or five inches long. They made a loud thud when they hit the floor after I swept them off the lab bench. They looked more like lobsters than insects, and I harbored the somewhat paranoid thought that the bril-

liant Dr. Ochoa may have created them to guard the lab in his absence, Golem insects to do his bidding.

The lab had a special "cold room." Most cold rooms, and I had worked in several by that time, were kept at refrigerator temperature, usually 4 degrees Centigrade (37° Fahrenheit) in order to inhibit chemical reactions that degrade proteins. This cold room had a second cold room inside of it that was kept at -10° C (14° F). This would freeze the spinach so that any natural proteolytic digestion would stop completely. The inner cold room had a giant 4-liter stainless steel spark-proof Waring blender. Large batches of highly flammable acetone were required as the solvent for the first step of the enzyme extraction. I was given a tattered, minimally insulated coat that offered little relief from the cold during the hours I spent grinding the leaves into a thick, combustible soup. When I emerged I was covered with a fine green, frosty mist and smelled, naturally, like a spinach salad. Fortunately, Michelle seemed to like spinach.



Flash Gordon's spaceship (1936)

That summer, the news was all abuzz about the coming moonshot, and even though I had more direct age-related interests to distract me, I still paid attention. How could I not? I think I was a typical child of the 1950's pre-space age, watching *Captain Video* and *Flash Gordon* reruns (originally a serial for movie theaters) on our black-and-white vacuum tube television. I went to movies about flying saucers and aliens with gigantic brains. I was home with the measles the week that Channel 9's "Million Dollar Movie" showed *Forbidden Planet* five times a day every day, and I got very familiar with the Krell and Monsters from the Id (although when I asked for more information about what the Id was, my parents didn't give me a straight answer). I was taken to the Hayden

Planetarium a few times a year for live star shows, which I enjoyed immensely. I started diligently following America's space program after the shock of Sputnik on October 4, 1957. The educational curriculum at P.S. 96 in the Bronx got an enormous science kick following the Soviet success, and my 5th and 6th grade classes were filled with batteries, buzzers, lights, lenses and more math in what was already a decent math curriculum. Two months after Sputnik, most of the school watched on television as the Navy's Vanguard I, our first attempt at a satellite, blew up on the launch pad after rising a total of four feet (dubbed "Kaputnik" by wags in the press). Fortunately, eight weeks later on January 31, 1958 Wernher von Braun's Juno rocket, an Army project, successfully placed JPL's Explorer 1 into Earth orbit. Von Braun claimed he had been ready to launch in 1956, but the Nazi military past of the Juno's creators was deemed by President Eisenhower to be too provocative for what was supposed to be a peaceful program during the Cold War.



Kaputnik, the Vanguard 1 launch, December 6, 1957

Even the science curriculum in junior high was amplified, my success in class spurred no doubt by wanting to impress our young, blonde, buxom 9th grade science teacher. At Bronx Science, great science education and strong math were a given, and I even learned computer programming. Science was then the only high school in the country that had its own computer. We were on the cutting edge, but it's revealing that in comparison terms, the cell phones that students carry in their pockets today are over a billion times more powerful than the room-sized, punch-card eating, 10 characters-per-second typewriter outputting but seemingly miraculous IBM 1620.

All over the world, America's global preeminence was being challenged. The national sense of invulnerability and historical righteousness that followed the end of the Second World War began to fade. A variety

of international crises challenged our fragile omnipotence: the Berlin blockade, the Korean War, the Soviet invasion of Hungary, the U-2 incident, Khrushchev's shoe-banging and threats at the U.N., Castro's victory in Cuba followed quickly by the Bay of Pigs fiasco and then the missile crisis that brought us to within 30 seconds of nuclear war, and then the slowly unfolding disaster of Vietnam. Our allies met similar defeats: Dien Bien Phu and Algeria for the French, the independence of India and Pakistan and the Suez fiasco for the British, decolonialization of Africa and the Middle East for both. We lost another round in the space race when the Soviets placed Yuri Gagarin in orbit on April 12, 1961. But we stayed in the fight. President John Kennedy's challenge to place "a man on the Moon and return him safely to Earth" was our response.

Mercury, Gemini and then Apollo proceeded with public interest waxing when a breakthrough occurred and waning when events more relevant to one's personal life took over. Of course Alan Shepherd's sub-orbital flight on May 5, 1961 and John Glenn's 3-orbit mission on February 20, 1962 were widely covered and Ed White's 23-minute spacewalk from Gemini 4 on June 3, 1965 got a lot of play as I recall. The flights became a bit routine, their success expected and the drama less intense. By 1967 the news most relevant to people my age was about Vietnam. The public's attachment to the concept of men in space did increase a bit when Stanley Kubrick's movie *2001: A Space Odyssey* came out in mid-1968. We flocked to see it, often under the influence of controlled substances, and basked in its meticulous wide-screen vision of a future in space. Even though the psychedelic ending was confusing to many, if you could figure it out it held the promise of transformation and transcendence, core hippie values. Then, just before Christmas 1968 and one month after a truly earthshaking event--the release of the *White Album*--Apollo 8 was launched, the first manned spaceflight out of the Earth's gravitational field. It was a confident conclusion to a year that began with the disastrous Tet Offensive in Vietnam, and continued with the assassinations of Martin Luther King and Bobby Kennedy, the Columbia uprising (as a senior there I was an eyewitness), the riots at the Democratic National Convention in Chicago and the election of Richard Nixon. I watched the live Apollo 8 Christmas Eve broadcast, with the Earth rising over the Moon's limb and the astronauts reciting Genesis. As exalting as it was, I was a bit uneasy, since I'm not one who thinks that science and religion can mix. I

figured though that it was just a traditional American incantation. After all, “In God We Trust” is still on our dollar bills, and even non-believers like dollar bills. I wasn’t as upset as the well-known militant atheist Madeline Murray O’Hair, who sued NASA in an attempt to ensure that further Apollo missions would be explicitly prohibited from transmitting readings of scripture. *O’Hair v. Paine*, 397 U.S. 531 was thrown out for “lack of jurisdiction” (did it need to be filed in a lunar court?). As an aside, Murray, her son and granddaughter were murdered in 1995 and their bodies dismembered and buried, a rather biblical martyrdom-style ending, you might think.

Apollo 11 was a more concentrated experience. The publicity buildup was effective in spite of continued bad news from Vietnam and ever-accelerating anti-war protests at home. Everyone realized this was a risky and momentous step, not to be taken lightly. It was an opportunity for America to win at last. Kennedy’s ghost was frequently evoked. Everyone in my generation remembers the exact moment that they heard about John Kennedy’s assassination, as everyone in my parents’ generation remembered where they were when they heard about Pearl Harbor. I am sure fewer remember exactly where they were when they heard “Tranquility Base here. The Eagle has landed” at 4:17 P.M. EDT on July 20th, but I recall it distinctly. I was in my somewhat beat-up but very cool 1964 Alfa Romeo Giulia convertible, on the Meadowbrook Parkway heading to a friend’s house. I was listening to WINS, the AM news station. Since I had to pay attention to the road, I wasn’t really keyed into the drama of the approach, but I distinctly recall the astronauts’ radio transmission. Later we watched the live feed from the surface. I followed the rest of the mission until the return to Earth on the 24th.

Although Apollo 11 held the attention of America and the world (NASA estimates 20% of the world’s population watched Armstrong and Aldrin walk on the lunar surface), the glow of triumph in the space race was short-lived. Americans are like cats: they are attracted by bright shiny things, but only temporarily. It didn’t take long to start hearing “If we can send a man to the Moon, why can’t we....” [build senior center over here or a school over there, feed starving children, provide housing for the homeless, cure cancer, etc.]. To much of the public the Moon landing began to be more of a trope than an actual technological and scientific achievement. It was something that made other wishes and even fantasies that much more achievable, reality notwithstanding. Issues with greater impact on

Americans’ lives took precedence, as one might expect. Will my child get a good education? Will I die of a disease that could have been cured if only the research had been done? Will I be drafted and killed in a swamp fighting a useless, clearly lost war? Americans’ expectations for social progress and economic comfort were inevitably amplified by President Lyndon Johnson’s Great Society program. There had been initiatives in voting rights, health care for the elderly and poor, education funding and many projects in the so called “War on Poverty.” President Richard Nixon’s 1971 “War on Cancer” is another example. Cancer’s still around. But the funds were headed in those directions.

Apollo 20, the final mission in the series, had been canceled after Apollo 12’s successful landing in November 1969. Apollo 18 and 19 were canceled after the failed Apollo 13 mission in 1970. Nixon tried to cancel Apollos 16 and 17 in 1971, but was rebuffed by then Deputy Director of the Office of Management and Budget (and later Ronald Reagan’s Secretary of Defense) Caspar Weinberger. By 1972, Apollo was “been there, done that” and there seemed to be little public outcry at its demise. Apollo 18’s Lunar Module is displayed at the Cradle of Aviation Museum in Garden City. About the only sign of continued public interest in space travel was the flowering popularity of *Star Trek* reruns. The program didn’t fare that well during its three years (1966-69) of network production, but by 1972 it was sprouting all over the country in syndication.

Only to a smaller and less vocal constituency did it appear critical that we continue to explore the Moon’s formation and geologic history with manned spacecraft. But the daunting technological challenges and enormous costs to continue lunar missions or maintain a presence on the Moon couldn’t be justified absent the kind of competition with our Soviet Union enemy that propelled the space program from Mercury to Apollo. It’s interesting to look at our current perceptions of Chinese space programs. We do our thing, and we let them do theirs. It doesn’t seem like a competition, at least from our side.

NASA shifted to Skylab and then the ISS in order to examine the effects of prolonged (longer than Apollo 17’s twelve days) space travel on human beings and to perform experiments in zero gravity. To make good on President Kennedy’s claim that America’s intentions in space were peaceful, the space station became an international project. American rocket development

turned to the Space Shuttle, which never lived up to its one-launch-a-week promise. The last Saturn V was launched in 1973, and since then no rocket has come anywhere near its thrust and payload-carrying capacity. Most of the ISS was brought up in small pieces. The Saturn V could place 140,000 kg into low Earth orbit; the Space Shuttle managed just 27,000 kg.

NASA's got very good at orbiting telescopes and ever more capable robotic Solar System probes. For the Moon that meant primarily orbiting survey instruments like Clementine or Lunar Reconnaissance Orbiter. For Mars, where erudite opinion held that the greater prize could be found, orbiting spacecraft, landers and rovers all made scientific breakthroughs. The two Voyagers, with their spectacular images of the outer planets and their moons, impressed even the average scientifically disinterested citizen. Mysteries on all of the planets, as well as Ceres, Vesta, Pluto, Ultima Thule and a bunch of comets and asteroids have been probed by a plethora of cleverly designed and managed missions. We learned much and encountered new mysteries that beckoned further exploration.

There is increasing appeal to return to the Moon as a prelude for human spaceflight to Mars. Recently, entrepreneurs like Elon Musk and Jeff Bezos have indicated their interest in privately funded space exploration, with Musk's SpaceX successfully launching its own rockets including the formidable Falcon-9 Heavy, capable of placing up to 57,000 kg of payload in low Earth orbit. Bezos recently showed his "Blue Moon" lander, but to me it's not transformational, just a modern riff on the Apollo Lunar Module.

In December President Trump announced "Space Policy Directive 1," which told NASA to develop a plan to return to the Moon and then to Mars. The details were released in mid-May.³ It's based on a public-private partnership. Eleven companies are to supply the hardware for a mission to the Moon's South Pole by 2024 and for a "sustainable" presence beginning in 2028. Some 37 launches would be required just to get going. The cost? Not stated, and for a good reason: no one knows, but it's likely to be over \$100 billion and I suspect substantially more. The Trump administration asked to fund the initial phase out of money intended for Pell education grants, something that Democrats in the House will never allow. An excellent analysis of

the technical and political aspects of the program was published on May 21st by the tech web site *ArsTechnica*.⁴ The technical challenges in NASA's plan are formidable, but they are insignificant compared to the political and economic obstacles.

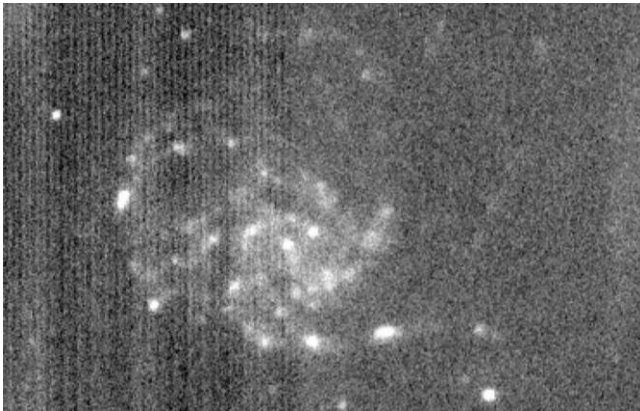
Musk's long-term goal is human habitation of Mars and economic development of space, which means mining for valuable minerals on planets or asteroids, or harvesting helium-3 from the Moon or Jupiter. Bezos's vision is for "millions" of human beings to live in space in artificial space colonies. Reality has a way of crushing fantasy. Astronaut Scott Kelly's genome was altered (and not for the better...he wasn't turned into The Hulk or Spiderman) by spending a year in space. This provides a serious but hardly unexpected warning about the deleterious health consequences of prolonged space travel. As for gigantic colonies in space, like those seen at the end of *Interstellar* and the massive space city Yorktown in *Star Trek: Beyond*, there are some daunting issues that seem unresolvable by current or even foreseeable technology, and basic biology and physics constrain solutions to some problems. How do you make steel in space, or smelt aluminum? Where do you put the waste that can't be recycled? How are our fellow-travelling microorganisms going to react or perhaps evolve, and what new public health burdens will arise in closed environments? How can we have transparent domes when thick lead is needed to intercept cosmic rays and particles of the solar wind? If the solution to radiation protection is a magnetic field, how can we make one equivalent to the Earth's without scrambling every electronic device that's anywhere near it? And perhaps underlying everything: what is the economic structure that makes such a society functional? To riff on Bill Clinton's famous 1992 campaign slogan: "It's not rocket science, it's the economy, stupid."

Absent an astonishing breakthrough in energy technology, such as broadcast power, portable fusion reactors, or *The Hitchhiker's Guide to the Galaxy's* Quantum Improbability drive, real space exploration 1950's and Star Trek style is inconceivable. Computers are about the only technology in which we've made truly transformational strides, and frankly much of that progress seems to have recently been used to make us stupider or more subject to surveillance. That's not to say that we shouldn't go back to the Moon for scientific purposes, or even travel to Mars to determine

³ <https://www.nasa.gov/press-release/nasa-taps-11-american-companies-to-advance-human-lunar-landers/>. Also take a look at NASA's video "We are Going" narrated by, who else?, William Shatner, at <https://www.youtube.com/watch?v=vl6jn-DdafM>.

⁴ <https://arstechnica.com/science/2019/05/nasas-full-artemis-plan-revealed-37-launches-and-a-lunar-outpost/>

whether life once (or still) exists there, although the likelihood of us bringing terrestrial life and contaminating the planet is greater than that of finding indigenous life. The Moon is an ideal place to site research telescopes that could be operated robotically with a skeleton maintenance crew, who would live in shielded domiciles. Even small telescopes would have real value for discovery, as was explained to WAA last year by Jon Morse, former White House space advisor and now head of BoldlyGo, the private space research organization. China has a small ultraviolet telescope on its Chang'e 3 lander, which has been operating since 2013. It is sensitive to magnitude 13.



M33 by Chang'e 3's 5.9" RC ultraviolet telescope on the Moon.

There is much to be said for continuing and enhancing the robotic exploration of the Solar System and the deployment of ever more capable space observatories, missions whose funding would undoubtedly be parasitized by hyperexpensive lunar colonization. Progress in astronomy has been exhilarating, and although it lacks the drama and passion of human exploration, to the educated mind it claims equal or greater value if the goal is to understand the universe. About the only bit of space exploration humans can do better than robots is dig, and I'm not sure that's going to be true in the future. Occasional short-term manned missions to the Moon and Mars are reasonable for scientific purposes. It may really be just a sales pitch to say they are a prelude to the mass transformation of *Homo sapiens* to *Homo cosmos*. In any case, the way things are going down on Earth, mass colonization of space can't possibly come soon enough to save us from ourselves as we continue to make the world uninhabitable through climate change and species extinction.

And yet...

NASA's new lunar effort, known as Artemis (the Greek goddess of the Moon), was introduced with these words:

NASA's Apollo Program was a stunning demonstration of the United States' strength of will and its economic, political and technological power – a feat that inspired generations of young people. It was fuel to the fire of the American consciousness that brought on a revolution, not only in science and technology, but also in our passion for exploration and discovery.

Just as Apollo inspired a generation 50 years ago, NASA continues to inspire with feats of science and exploration today. If we bring together the capabilities and resources of our international and commercial partners to take us forward to the Moon and on to Mars, we will demonstrate to people around the world the power of a unified purpose. It will serve as an unparalleled and inspiring example of what humanity can do when it comes together to achieve a common goal for the common good.

When I look at a wonderful image of the Martian landscape taken by a rover, I don't quite get the same feeling that I get from looking at a photo taken from the surface of the Moon by an Apollo astronaut. Although I won't ever be in either place, I feel far more "there" with Armstrong and Aldrin, or Cernan and Schmitt, than I do with Opportunity or Curiosity. When one person does it, we all do it. As the memory of our visit to the Moon fades we may need to go there if only to prove to ourselves that we are not merely degenerate shades of our forefathers.

Tennyson wrote,

Tho' much is taken, much abides; and tho'
We are not now that strength which in old days
Moved earth and heaven, that which we are, --
One equal temper of heroic hearts,
Made weak by time and fate, but strong in will
To strive, to seek, to find, and not to yield.

Who isn't inspired by *Ulysses*? Who wants to admit our best years and deeds are behind us? Who doesn't want to "demonstrate to people around the world the power of a unified purpose?" We're certainly not demonstrating it in our political system right now. Just switch back and forth between MSNBC and Fox News and that will be obvious. It may have been cheap and easy for Ulysses to gather a few mates and sail off to plunder somewhere in the Mediterranean. A trip back to the Moon, absent an economic miracle that erases the Federal deficit and floods the Treasury with huge amounts of cash, means not funding a myriad of other projects and benefits that most people and their representatives think are more important. As it was said in *The Right Stuff*: "No bucks, no Buck Rogers." ■

Lunar Reminiscences

Rick Bria

On July 20, 2019 it will be 50 years since humans first walked on the Moon during the Apollo 11 mission. With all the technological advances since then, the Apollo 11 mission still remains an amazing achievement.

My wife Mary Ann and I went on a Hawaiian cruise to see the 1991 total solar eclipse. We met Michael Collins there and had our picture taken with him. He was the command module pilot for the Apollo 11 mission. We found him to be an amazing, kind and generous human being. I can only wonder how many people he and NASA have inspired.



I was in grammar school during the Apollo missions. Everyone in my class, myself included, wanted to be an astronaut. We all wanted to go into “outer space”. The term “outer space” seems so strange now, but

back then that was what we called it. Although I never ventured into “outer space,” witnessing NASA's success got me interested in astronomy.

Like Ralph and his BB gun in the movie *A Christmas Story*, I have vivid memories of the best Christmas present I ever received: a Sears 60mm refractor telescope. These days I have access to some of the most advanced astronomy equipment available, but I will never forget the telescope that started a lifelong journey. I'm not sure if I'm blessed or cursed. I often spend nights freezing or sweltering (mostly alone) scanning the night sky. Thanks to NASA and my parents, I've become what most of the Earth's inhabitants refer to as a lunatic... also known as an amateur astronomer.

Of all the pictures I've taken of the Moon, I especially like the illumination and phase of one I took a few years ago. [Image on the next page.] The Apollo 11 astronauts landed in a smooth dark lava plain called the Sea of Tranquility. I marked it with **X11** to show where the Apollo 11 mission landed. You'll need to zoom to find **X11**.

I'm often asked if we can see the flag or other equipment left behind by the astronauts with our observatory telescope. Due to the blurring effect of the Earth's atmosphere and the physical limitations of optics, it is not possible to see anything that small from Earth. ■

On the fourth or fifth day after new Moon, when the Moon is seen with brilliant horns, the boundary which divides the dark part from the light does not extend uniformly in an oval line as would happen on a perfectly spherical solid, but traces out an uneven, rough, and very wavy line as shown in the figure below. Indeed, many luminous excrescences extend beyond the boundary into the darker portion, while on the other hand some dark patches invade the illuminated part. Moreover a great quantity of small blackish spots, entirely separated from the dark region, are scattered almost all over the area illuminated by the sun with the exception only of that part which is occupied by the large and ancient spots. Let us note, however, that the said small spots always agree in having their blackened parts directed toward the sun, while on the side opposite the sun they are crowned with bright contours, like shining summits. There is a similar sight on earth about sunrise, when we behold the valleys not yet flooded with light though the mountains surrounding them are already ablaze with glowing splendor on the side opposite the sun. And just as the shadows in the hollows on earth diminish in size as the sun rises higher, so these spots on the Moon lose their blackness as the illuminated region grows larger and larger.



Galileo Galilei, *The Starry Messenger*, 1610



Rick Bria's image was taken through a Takahashi FSQ106 refractor with an SBIG 11k Camera using an Ha filter. The exposure was 0.11 seconds. Taken at Round Hill Observatory in Connecticut.

You develop an instant global consciousness, a people orientation, an intense dissatisfaction with the state of the world, and a compulsion to do something about it. From out there on the moon, international politics looks so petty. You want to grab a politician by the scruff of the neck and drag him a quarter of a million miles out and say, "Look at that, you son of a bitch."

Astronaut Edgar Mitchell (Apollo 14 Lunar Module pilot)

WAA's New (Old) Lunar Telescope

Larry Faltz & John Paladini

Any decent telescope will give marvelous views of the Moon. Optimizing the view, especially at high magnification, means optics that provide high resolution and great contrast. Looking at the diffraction pattern of a point source, like a star, is a good test. The pattern should show most of the light at the source and in the first diffraction ring and should be similar both inside and outside focus. There are some good on-line references about star testing, for example http://www.backyardastronomy.com/Backyard_Astronomy/Downloads_files/Appendix%20A-Testing.pdf.



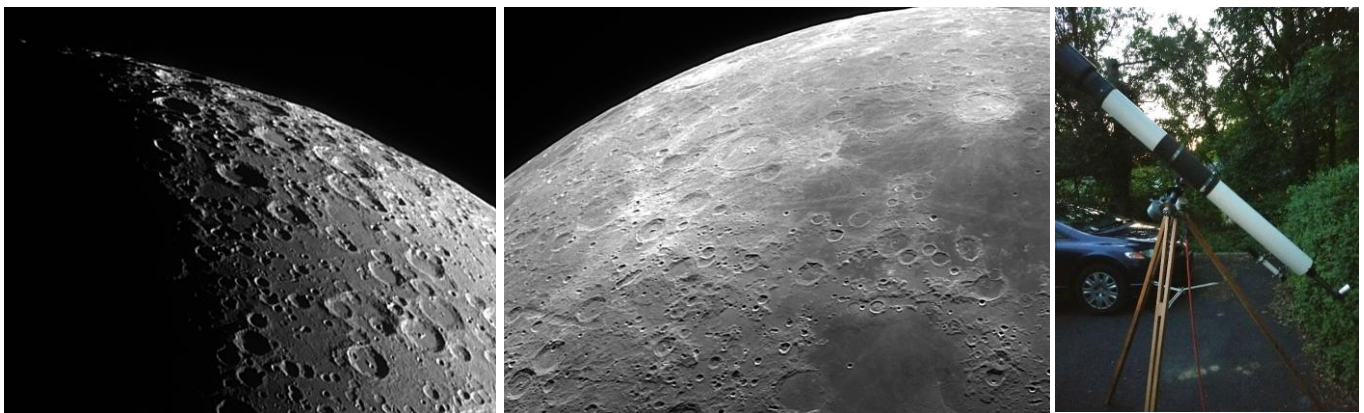
A perfect refractor star test, with identical and symmetrical patterns inside and outside of focus.

As Gerald North says in *Observing the Moon* (Cambridge University Press, 2000), “the instrument that comes closest to providing the textbook diffraction pattern structure is the refractor.” Another consideration is chromatic aberration. The longer the focal length, the lower the chromatic aberration, which in turn improves contrast. In days of yore, before ED glass and triplet objectives made shorter, faster refractors popular, the two-element (crown/flint), long focal length refractor ruled the roost. Perched on tall wooden tripods, these three- and four-inch (and sometimes 6-inch) f/15 telescopes were the main instrument of serious amateur astronomy, rivalled only in common

use by the 6-inch f/8 reflector, itself not a bad telescope for lunar and planetary observing, but adding the problem of collimation to optimize the image. Also, the reflector was not as impressively “telescopic” as the long-tube refractor.

WAA owns two f/15 refractors. Our venerable 1948 six inch f/15 Saturn is on long-term loan and undergoing a lengthy restoration. A couple of years ago, we received a four inch f/15 Edscorp (Edmund Scientific) refractor, probably manufactured in the mid- to late-1960's. Three and four inch Edscorp telescopes have a very high reputation among classic telescope enthusiasts. The objective on our scope had a lot of dirt on it and one small area of fungus. The tube was scratched but not dented. The rack-and-pinion focuser was loose. John cleaned up the objective and the telescope, tightened the focuser and did a star test. The diffraction pattern was essentially perfect. The telescope came with a 1/4" (6.4 mm) Ramsden eyepiece (giving 238x), a primitive 2-element design which is fairly useless for observing because of aberrations and poor eye relief, but a modern Plossl will give fine views.

John has a lovely 3" Edscorp with mount and he attached the newly cleaned 4" on that scope's GEM mount. Here are two lunar images made on June 8th, showing the capabilities of this instrument. It may be a fun telescope to use for outreach for planetary viewing if we can find the right mount for it. Given its length, the tripod has to have substantial height. But it sure looks like a “real” telescope! ■



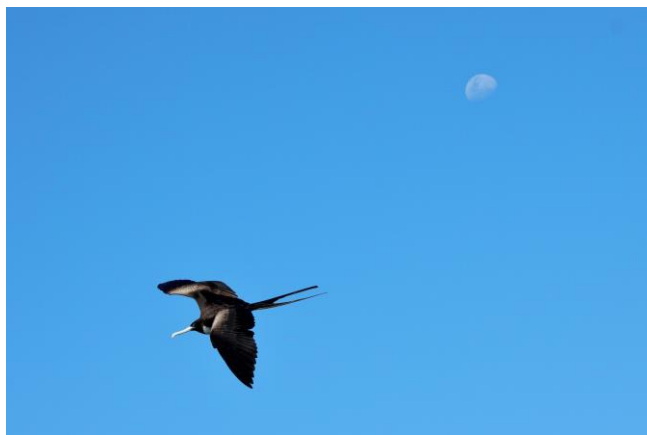
Point Grey Chameleon camera, best 100 frames stacked and processed in Registax.

A Gallery of Lunar Images

To commemorate the 50th anniversary of the Apollo 11 landing, we asked club members to submit images of the Moon, not necessarily telescopic in nature. I've included a couple of my own (LF).



It's not a photo! Howard Fink carved a scale model of Harpalus Crater from a piece of Maple lumber 1" thick and 9.5" square, using data from combined LRO-JAXA dataset SLDEM, found at Map-A-Planet 2.



Frigate bird and Moon over the Galapagos on March 16th (Larry Faltz)



Dave Parmet took this lovely shot of the young Moon, complete with Earthshine, at the April 6, 2019 WAA star party at Ward Pound Ridge.



Plato, the Alpine Valley and the Moon's northern zone, 3/26/18. Stellarvue SVR105 f/7 triplet on iOptron Minitower, QHY 5L II, Autostakkaert!2, Registax wavelets (Larry Faltz)



Bill Newell brought his collection of original newspapers and magazines reporting the Apollo 11 Moon landing to the Star Party on May 24th.



The crescent Moon with Earthshine is seen (upside down, however: see inset) on this large tin-glazed earthenware (maiolica) vase made about 1560 in Urbino, Italy. It's prominently displayed in the Philadelphia Museum of Art. It illuminates a scene from a popular 16th century Spanish novel, *Amadis de Gaula*. Night scenes are apparently rare in this style of ceramic.



Murasaki Shikibu Gazing at the Moon. Tosa Mitsuoki (1617-1691). Hanging scroll painting (ink on silk). A classic of Japanese literature, *The Tale of Genji* was written between 1000 and 1012 by the noblewoman Murasaki Shikibu. Legend has it that she started the work after seeing the Moon reflected in the water at Ishiyamadera Temple in Otsu (founded 747 CE), guided by the bodhisattva Kannon. This painting, owned by the temple, was displayed at the Metropolitan Museum of Art's 2019 exhibition on art inspired by *The Tale of Genji*. The inscription is from Chapter 12, describing the exiled Genji gazing at the Moon. Murasaki is said to have started writing the novel with this chapter.

Star Party May 24th

In mid-May, WAA was contacted by Big Fish Entertainment, an independent production company making a documentary on the Moon landings for the Science Channel. The show focuses on scientifically evaluating the conspiracy theories that claim that the Apollo missions were faked. For one episode, they wanted a background of a star party. We were happy to participate, since the Science Channel is about real science (unlike the History Channel, which seems to find aliens behind every historical event). Although we only had 4 days' notice to accommodate their shooting schedule, an email blast on Monday, May 20th brought out over two dozen telescopes on Friday, ranging from 2 inches to 22 inches in aperture. The pre-dusk filming used the Meadow Parking Lot in Ward Pound, our usual venue, as a backdrop as several people, including a NASA astronaut, were interviewed just up the hill to the south. A drone buzzed around the field before dusk filming us as we set up our telescopes. Unfortunately the sky didn't cooperate much in spite of optimistic predictions earlier in the day, but that turned the star party into a massively social event, as all star parties should be!



The program, *The Truth behind the Moon Landing*, began airing on the Science Channel in June on Sunday evenings. Past episodes are on the Science Channel web site. We're supposed to be in the June 30th episode. ■

Research Highlight of the Month

Prolonged residence on the Moon as envisioned in NASA's Artemis plan is dependent on harvesting lunar water. In 2017, two Brown University scientists modelled water on the lunar surface using data from a NASA instrument that flew aboard India's first lunar mission, Chandrayaan-1, launched in 2008. Here's the abstract and two of the figures from the paper.

Shuai Li, Milliken, RE., Water on the surface of the Moon as seen by the Moon Mineralogy Mapper: Distribution, abundance, and origins, *Science Advances* 13 Sep 2017: Vol. 3, no. 9, e1701471, DOI: 10.1126/sciadv.170147

Abstract: A new thermal correction model and experimentally validated relationships between absorption strength and water content have been used to construct the first global quantitative maps of lunar surface water derived from the Moon Mineralogy Mapper near-infrared reflectance data. We find that OH abundance increases as a function of latitude, approaching values of ~500 to 750 parts per million (ppm). Water content also increases with the degree of space weathering, consistent with the preferential retention of water originating from solar wind implantation during agglutinate formation. Anomalous high water contents indicative of interior magmatic sources are observed in several locations, but there is no global correlation between surface composition and water content. Surface water abundance can vary by ~200 ppm over a lunar day, and the upper meter of regolith may contain a total of $\sim 1.2 \times 10^{14}$ g of water averaged over the globe. Formation and migration of water toward cold traps may thus be a continuous process on the Moon and other airless bodies. ■

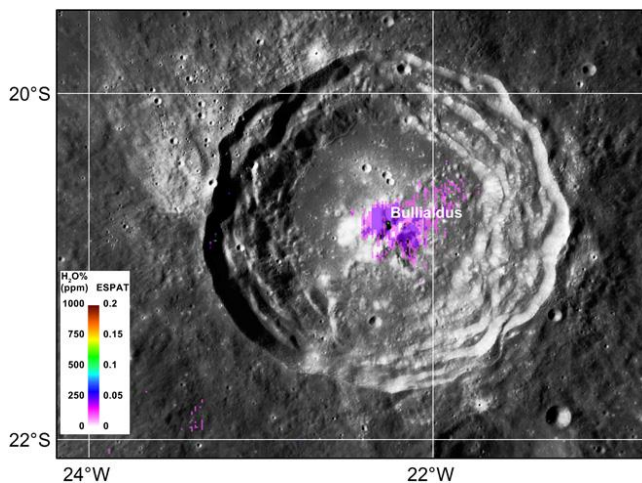


Fig. 8 Water content map for Bullialdus crater exhibiting increased hydration in central peak, approaching values of ~250 ppm.

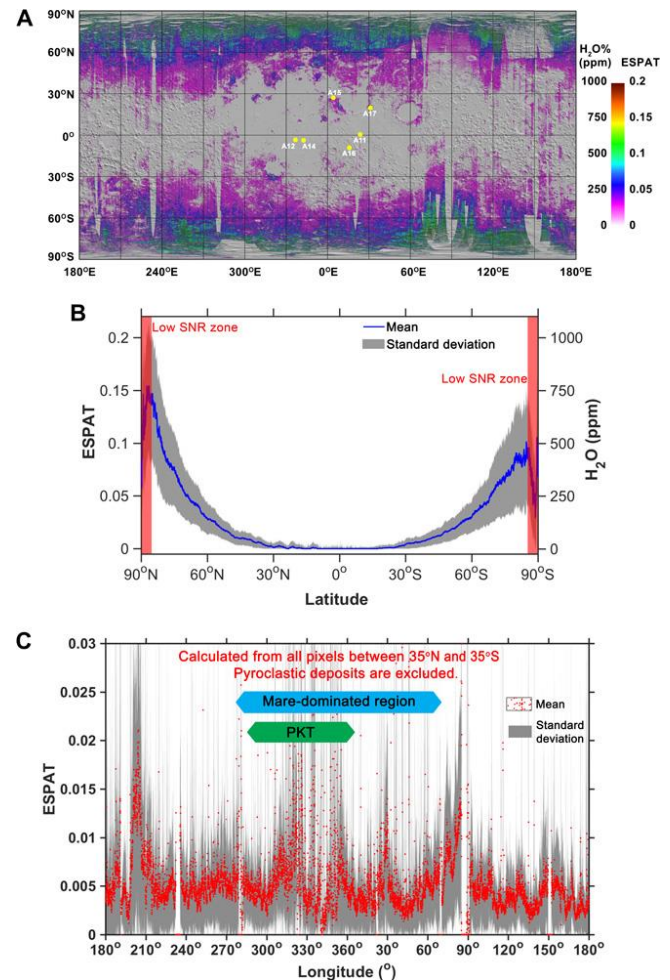


Fig. 1 Water content of the lunar surface as derived from the M3 data. (A) Global map of effective single-particle absorption-thickness (ESPAT) values (at $\sim 2.86 \mu\text{m}$) and estimated water contents (assuming that the irregularly-shaped particles have a diameter of 60 to $80 \mu\text{m}$) calculated from the M3 data overlain on a Lunar Orbiter Laser Altimeter shaded-relief map. Apollo landing sites are labeled with yellow dots. (B) Latitude profile of ESPAT and water content derived from (A) when averaged over all longitudes. (C) Longitude profile of ESPAT values averaged over all latitudes between 35°N and 35°S . Light blue bar indicates the approximate latitude range of mare dominant region. The green bar shows the approximate latitude range of PKT. PKT, Procellarum KREEP Terrane.

Member & Club Equipment for Sale

Item	Description	Asking price	Name/Email
Celestron 8" SCT on Advanced VX mount	Purchased in 2016. Equatorial mount, portable power supply, polar scope, AC adaptor, manual, new condition.	\$1200	Santian Vataj spvataj@hotmail.com
Celestron CPC800 8" SCT (alt-az mount)	Like new condition, perfect optics. Starizona Hyperstar-ready secondary (allows interchangeable conversion to 8" f/2 astrograph if you get a <u>Hyperstar</u> and wedge). Additional accessories: see August 2018 newsletter for details. Donated to WAA.	\$1000	WAA ads@westchesterastronomers.org
Celestron StarSense autoalign	New condition. Accurate auto-alignment. Works with all recent Celestron telescopes (fork mount or GEM). See info on <u>Celestron web site</u> . Complete with hand control, cable, 2 mounts, original packaging, documentation. List \$359. Donated to WAA.	\$200	WAA ads@westchesterastronomers.org
Explore Scientific Twilight I Mount	Manual Alt/Az, capacity 18 lb. Steel tripod. Excellent condition. Used fewer than 10 times. Great for grab-and-go viewing. Owner upgrading to an EQ mount.	\$110	Eugene Lewis genelew1@gmail.com
Televue Plossl 55mm 2-inch	Very lightly used. Excellent condition. Original box.	\$110	Eugene Lewis genelew1@gmail.com
Astro-Tech AT102ED Doublet, f/6.95	ED glass, dual speed FeatherTouch focuser, retractable dew shield, one tiny scratch on the tube, optics perfect. Original travel case. Tube rings, Orion/Vixen dovetail. AstroTech 2" dielectric diagonal and AstroTech red-dot finder included. Rarely used, purchased 2009.	\$625	Susan Lewis saw16633@gmail.com
Lunt LS60THa Solar Telescope	Like-new 60mm pressure-tuned scope with B1200 blocking filter and 2-inch Feathertouch focuser. Cost new \$2479. Televue Sol-Finder, tube ring and vixen dovetail, original metal case with custom fit high-density foam. Two plossl eyepieces. Used only 5 or 6 times. Just don't have the time to use it enough to warrant keeping it	\$1700	Eugene Lewis genelew1@gmail.com
Universal Astronomics Unistar Heavy Deluxe Alt-Az mount	2" Jaw, UA Medium Aluminum Tripod w/ Fixed Spreader, Adjustable Guide Handle, Heavy Tripod Mounting Post 5/8-11. Very good condition. .	\$275	Susan Lewis saw16633@gmail.com
Celestron 8" SCT OTA	Dark blue 8" f/10 Schmidt-Cassegrain optical tube with Telrad base and ADM dovetail plate installed. No finder.	\$250	Dave Parmet david.parmet@westchesterastronomers.org

Want to list something for sale in the next issue of the WAA newsletter? Send the description and asking price to ads@westchesterastronomers.org. Member submissions only. Please submit only serious and useful astronomy equipment. WAA reserves the right not to list items we think are not of value to members.

Buying and selling items is at your own risk. WAA is not responsible for the satisfaction of the buyer or seller. Commercial listings are not accepted. Items must be the property of the member or WAA. WAA takes no responsibility for the condition or value of the item or accuracy of any description. We expect, but cannot guarantee, that descriptions are accurate. Items are subject to prior sale. WAA is not a party to any sale unless the equipment belongs to WAA (and will be so identified). Sales of WAA equipment are final. *Caveat emptor!*