[An online publication of the Milwaukee Lunar Reclamation Society, a chapter of the National Space Society & of the Moon Society & an Outpost of the Mars Society]

OUTBOUND #23 NOVEMBER 2019

Note: all the "Mars-focused issues" of 30 years of Moon Miners Manifesto are now online in one theme-focused issue:

https://space.nss.org/media/Moon-Miners-Manifesto-Mars.pdf

The link above does not include articles in Outbound, a no set page limit web-publication, in pdf form only, introduced after we had stopped publication of Moon Miners' Manifesto with MMM #300, 30 years!

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Coming Up: MLRS Holidays Dinner Party
Bring a side dish to share
Saturday, December 6th @ the Wauwatosa Library N 76th & W North Avenue, in the "Firefly Room" 1st floor, 1pm & following

Parking & Entry at the rear side of the building,
a short distance south of North Avenue.

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Getting to the Moon is <u>the easy part</u>:

Safe landings on the Moon's"farside"
(never facing Earth and not visible from Earth) are not!

One success (China) and Two Failures in a Row (Israel, India)

<u>Making a soft landing is something else; doing it on the far side,</u>
<u>out of "direct" sight of Earth, indirectly via in orbit relay satellites is quite a feat</u>..
Recent Moon probe successes (China) and failures (Israel, India)
(Three countries that have sent probes to the Moon since the last American probe)

China's Chang'e 4,a lander and rover, was launched on 7 December 2018 and landed on 3 January 2019 on the South Pole-Aitken Basin, on the far side of the Moon, **the first probe to land safely on the Moon's farside**. A sample return **mission**, Chang'e 5, is scheduled for this December 2019.

SpaceIL is an **Israeli organization, established in 2011,** that was competing in the Google Lunar X Prize (GLXP) contest to land a spacecraft on the Moon. SpaceIL successfully launched its **Beresheet lander** on February 22, 2019 at 01:45 UTC; ***it entered lunar orbit on April 4, 2019*** at 14:18 UTC, ***but it failed to fire its retro rocket in order to make a soft landing, and crashed.***

SpaceIL is an Israeli organization, established in 2011, was competing in the Google Lunar X Prize contest to land a spacecraft on the Moon. But the contest was over long before the probe was launched.

India lost contact with its **Vikram lunar** lander **Sept. 6, 2019** during a daring attempt to make history as the first country to land near the Moon's south pole. ... "Subsequently the communications from the lander to the ground station was lost

<u>The Moon is far from being visited thoroughly</u>

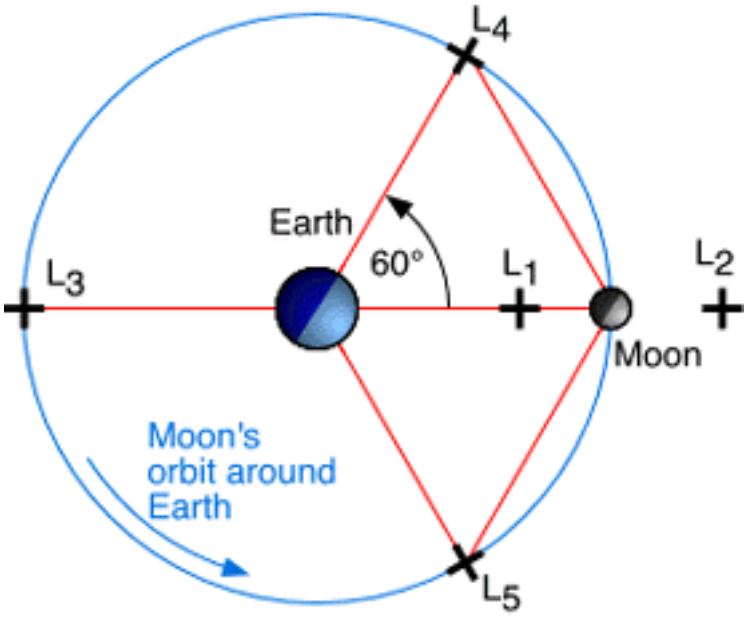
Areas visited on far side, and where we should go next.

Areas on the nearside that should not be overlooked: M Frigoris, Imbrium, Alpine Valley, Crisium, etc., PLUS partially ice filled craters above 30° North

Successful non-American Moon Farside Missions to date

China's Chang'E-4 - the fourth version of a lunar spacecraft **named for the Chinese goddess of the Moon,** landed on the far side of the Moon. ***Due to the location of the landing, Chang'E-4 had to navigate autonomously, without the guidance of scientists on Earth. [Something NASA has yet to try, iirc.***

Chang'E 4 was a robotic spacecraft mission, part of the 2nd phase of the Chinese Lunar Exploration Program. It achieved **the first soft landing on the far side of the Moon, on 3 January 2019**. A communication relay satellite, **Queqiao**, was first launched to a halo orbit near the Earth-Moon **L_2 point** in May 2018. **Queqiao was positioned to relay Chang'E 4**'s landing and movents from behind the Moon, where no "direct contact" with Earth is possible.



MARK YOUR 2020 CALENDAR

National Space Society's <u>next International Space Development Conference</u>

in Dallas, Texas, May 28-31, 2020, <u>theWeekend *AFTER* MEMORIAL DAY</u>

At the **<u>Embassy Suites by Hilton Dallas-Frisco Hotel & Convention Center</u>**

We hope to be there, (and be able to sign my next 2 Books:)

√ <u>A Pioneer's Guide to Living on Mars</u>

√ <u>A Pioneer's Guide to the Rest of the Solar System</u>

———————No, I'm not stopping then!———————

I have a book up my sleeve about the ~~Universe~~ "Omniverse."

I started brainstorming this venture just before my 24th birthday, in December 1961, **after a "eureka" moment one star-studded night in a NNE suburb (Totteridge) of London, England** where I had been going to school, and into my second year there after **5 years college, 1st year in Milwaukee, and 4 years in Pennsylvania.**

I had fallen in love with England (I had seen much of it outside of London) and I seriously thought about living there the rest of my life. But I decided to return to Milwaukee so I could be with my siblings. Wouldn't you know it, no sooner had I returned to our home town when my 2 brothers and 2 sisters all moved out of town, one still elsewhere in Wisconsin, 2 in Washington State, one deceased.

(I still wonder what my life would have been like if I were still living in London, these nearly six decades past (1962-2020).
It took me months to get rid of my British accent after returning to Milwaukee! LOL!

*It took trying (successfully) to start a new chapter ["Milwaukee Lunar Reclamation Society"] of the **National Space Society** (I had become life member #2 for a well-spent $100), and to launch "**Moon Miners' Manifesto**," ten times a year for 30 years, before I stopped, and soon after launched "**Outbound**" which, as it had **no fixed schedule** **nor fixed page limit**, and so is **less of a burden**, plus a lot of fun!"*

Outbound" is not printed, just a pdf file to be downloaded.

But it took all these years to get where we are now! So no regrets. PK

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Important Mars Missions yet to be flown

Pavonis Mons

***Pavonis Mons** is **astride Mars' Equator** and should be laced with intact lava tubes,*
*√ **a highway from Pavonis to "the source" of Valles Marineris**, √ **Blazing** rim-top road **trails**, and road trails into and along the valley floor, etc. √ And a highway through its sprawling delta to the Great Northern Basin*
√ Pavonis Mons' high crater rim on Mars' equator is a great spot for astronomical observatories, (in general, but specifically focused on near approaching asteroids, Jupiter's moons, etc.
√ Its Eastern slope on the equator is a perfect spot for a launch track rail towards crater rim, both for incoming spacecraft, and outgoing space craft
√ In sum, probably the most important piece of real estate in the entire Solar System

The Search for Water on Mars

√ Ongoing search for WATER, in deeper "Planitia," in volcano craters, and in volcanic mountain lava tubes?

√ <u>To date,</u> Water Ice "glaciers" have been found in two places, in Utopia Basin and in Hellas Basin

Mars missions yet to be flown: <u>an "Elevations Mapper"</u>

√ 1: Search for <u>indications and/or traces of former shorelines</u> in the great northern "ocean like" basin *(likely erased by mega years of weak winds)*

√ 2: An "<u>Elevations Mapper</u>" - To plan highways and railroads on Mars, we need <u>a much more detailed map of elevations on Mars, to avoid steep hills, natural ditches and valleys, and other obstacles to avoid that would call for bridges or tunnels</u>.

Of all the probes that it would be good to have, <u>this "Elevations Mapper" mission is by far the most in need before we can plan where to build settlements, and how to route highways and railroads to connect them.</u>

√ 3: Routing sealed tube "CANAL /Channels" from northern and southern "<u>sub</u>polar" ice caps to basins (which may or may not have subsurface frozen seas?)(they may need pumps to cross over higher basin areas)

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√ Progress: Book 2 ,About Mars, has now gone to the editor, James Burk:

"<u>A Pioneer's Guide to Living on Mars</u>"

√ <u>Book 3</u> > "<u>A Pioneer's Guide to the Rest of the Solar System</u>" now in the works: <u>about the rest of the Solar System</u> (***<u>outward</u>:*** **Jupiter, Saturn, Uranus, Neptune, Plato-Charon binary planet, and beyond.**) (***<u>inward</u>: 3 Largest asteroids,*** **Mercury, and then <u>Venus:</u>** ***<u>the greatest challenge for settlement of them all</u>***.)

ALSO: **<u>Space Settlements revisited</u> (all with one flaw which can be fixed, and how) Book 3** will be a snap in comparison to the previous two about the Moon, and Mars, as it will introduce only a few new concepts, the rest being a selection of articles already published in MMM through thirty years. ##

As I could not squelch the Writer's Zeal that easily, having ended thirty years of writing Moon Miners' Manifesto, 10 issues a year, I soon started "Outbound" but with no set page limit and no set publication dates, much less of a burden, though I have been putting out "Outbound" monthly, the last year or so.

Why do all this? √ #1,It's fun! #2, ***much of what I write in Outbound will find it's way into future books (already the case with #2, the Mars book, "A Pioneer's Guide to Living on Mars" - finished and soon to be published) and then continuing in Volume #3, "The Rest of our Solar System. and Beyond!"***

To be followed with **a 4th book about the origins of the universes, (plural) yes and an infinite number of them,** as well as what makes us humans and other intelligent species work throughout **the "Omnivese" -** with the tentative title **"The Omega Factor," clue: unlike all religions, the "almighty" pulls, not pushes, thus is Omega (the last letter in the Greek Alphabet, not the first ("Alpha").**

As there is no guarantee I will live long enough to finish all these books, I will try to outline them all, in the hopes that if need be, someone can pick up were I leave off.#

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Back to our Time and Place here on Earth in a Multi-Planet System.

Up until recently, "Earth was the World"

Now it is "Our First World", or "Our Home World"

The Moon and Mars are bound to become new homes for humanity

With "Space Settlements" and the larger "moons" of Jupiter, Saturn, Uranus, Neptune and the Pluto-Charon Binary planet coming next.

Then back to the center of our Solar System,

First Mercury's future role as the "Grand Central Station" of our Solar System, then Venus (mankind's greatest settlement challenge by far and how we might succeed.) Stay tuned!

What would be a "Binary Planet"?

I believe that we have such a situation in our Solar System:

"Wherever the center of gravity of 2 bodies lies *BETWEEN* them, NOT somewhere beneath the surface of the larger body, as is the case with all the "moons" (including ours) of all planets,

until now.

We are confronted by two bodies, one admittedly larger, but *the second body massive enough so that their mutual center of gravity lies BETWEEN them, in space*

And that is precisely the situation for Pluto and Charon

By these guidelines, Charon is "not a moon" or "satellite" of Pluto, but "the smaller of a pair" which together is a "Binary Planet." No other planet in our Solar System has a moon so large in mass to pair with the larger body this way.

That collectively, **the "Professionals" of the Astronomical Association *have not noticed this difference, says little positive about their study of Pluto-Charon, and sheds doubt about their having earned a "Professional" Stature***

And you can quote me on that. *Peter Kokh kokhmmm@aol.com*

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In the works (a long way to go):

√ If "I" [me, Peter Kokh] **were "The Martian" in the book and movie by that name, what would I do to survive and become the first "Martian"Settler"?**

(Background: I am a person who immediately accepts unwanted facts or events and starts immediately to adjust to what could be a terrible situation, having done so, more than once in my 82 years and running)

So if I were to be so lucky as to get to Mars, and if I were left behind, because I couldn't get back to the ship on time, what would I do to "hang in there?"

Would the crew have dropped out the door things that they could spare? First aid stuff, clothes and bedding, some food????

Wouldn't that just delay the fatal outcome?

I wonder how I would handle the situation, alone on Mars, and assumed to be dead. With no guarantee that I would succeed and would remain on Mars until a "delayed" natural death. - just an attempt. (I.am writing this for the fun of it.). ##

I WAS STRANDED ON MARS

Report by Simon Cook

I had planned to be AWOL, secretly of course, when the crew had to take off, headed back to Earth, and as the launch window came to the end, they had no choice but to leave me behind.

Just in case I was still alive, they left a pile of things they did not need, including: any of their own clothing that they did not need for the flight back to Earth, my share of canned food and bottled water, and everything in my cabin: a mattress with pillow and blankets, soap, towels, books I had not yet read, etc.

Meanwhile, I had found a North-facing cave, out of the wind, that would let sunshine in during the midday hours, Luckily in the NE corner of the deep Hellas Basin not far from where we had first landed and where Mars atmosphere is the thickest, and where it cools more slowly when the sun sets.

I have put outdoors some experiments included seedlings in pots with “fertilizers” in channeled sunlight (for heat too), and a water tank with liquid fertilizers. I have also put a thick walled insulated-barrel of water inside this shelter which was heated by channeled sunshine in daytime, as its “cap” opens when heated by the rising sun, and closes at sundown, retaining daytime heat through the night, without me needing to remember *“what to do when.”*

I had set aside 1/3rd of my limited food rations every day, enough for a few extra weeks, and by then, I hoped some of the seeds I had planted would be near harvesting. I have also arranged a way to channel sunlight inside during daytime, to heat water (and the urine tank) and to give off that heat at night, including a water “mattress” on which I sleep through the night, and which I put outside under the sunlight through the next day, to warm it up.

I had “Improved” the shelter by adding a rock tunnel entrance, just large enough for me to crawl through with a sack of items to store inside. By a careful rearrangement of mirrors, I still had sunshine inside for several hours each day.

(I had not wanted any fellow crew mate to discover what I was doing.)

Layers of clothing (including some that other crew mates left behind) should keep me warm enough through the night.

I baked my feces to kill any germs, and then grated it for fertilizer for plant soil, for those vegetables that grow fast and ripen more quickly.

I have a sunlight-powered music player, and had saved all my favorite instrumental disks.I have also stored enough blank paper for me to log everything I would do for a few months

I was luckily that none of my fellow crew mates had noticed me stockpiling these things, behind a 3 ft high “wall” deeper into that cave that some of them had visited earlier and had told me about it, little realizing that I would make it my hideaway.

I knew that all these provisions would come to an end, used up, and if I had not found a way to add more by then, my time would be up. But hopefully, my log book would be found someday, during another mission not so far from here so that a crew might be able to visit the site where my crew had landed.

If things go as planned, my daily notes would be a treasure house of experiments that had worked and had good results, as well as those that had been working but came to an end, and those that failed with notes as to why.

Someday, visitors to this then “historic area,” might wander and find this cave with my shriveled up remains, hopefully with a smile on my face, and then they would “burry me” near the entrance of that cave. What more could I ask for? ***Thanks for listening!*** Simon “Rocky” Cook

“er. ,” Peter Kokh, names that mean “Rock (Latin “petra”) Cook (German “koch”)

*(In 1986, I legally changed my family name from Koch to Kokh to prevent people form mispronouncing it as “kut**ch**" instead of Kaw**k***

[with all these new “Rock Recipes” for the Moon, Mars, and Beyond]

[The tale above is not my first attempt at fiction, but may be the first to be printed. It was simply a case of putting myself in ***the Martian***’s shoes and tell how I would handle such a situation. ***I have explored forests, and I climbed a mountain by myself, twice***, at 17 & 34, Mt. St. Piran, North of Lake Louise, in Banff National Park, Alberta, Canada.]

Bringing "Gaia" ("Earth Life") with us to the planets, continued

- **Europa:** a moon with an ocean below an icy crust with cracks all over, presumably letting some of that water to shoot up onto the surface. *Are their traces of life in those rust-colored cracks?* If so, *are there clues as to how far life in that hidden ocean has evolved?* What could be its future? Should we try to constructively speed things up? ***Why do we not plan to land instruments that could examine those cracks, looking for clues for life, or finding other causes of these colors*.** NASA will spend only nickels and dimes to find out more than the little we already know. ***For shame, NASA! (and the American Congress!)***

  - **If we do find traces of life in Europa's hidden ocean, how advanced might it be? How thick is this ice (and somehow keep the water below from shooting through our drilled opening) and what equipment would we need to drill through it *and lower "cages" down into that ocean and bring up samples, here and there until we are satisfied that we have answers to all our questions,*** without sending a probe down through this ocean, estimated to be about 60 miles deep, to where we might ***find out why this ocean is warm enough not to be frozen solid***?

  - **If we do find life, how basic and primitive will it be?** Might we find ***signs of advanced, multi-cellular life just by examining the stained cracks in Europa's surface***, we may well find some clues, in ***any organic molecules*** we find in these ice cracks. But trying to do this from an Europa orbiter, instead of landing a craft on the ice surface seems to me a clue that NASA's experts should not have graduated from kindergarten. Just the opposite: **we could expect to find much more if we drill through this ice crust and lower probes into the ocean itself below.**

  - ***The only way to tell for sure is to do just that, DRILL down into that Ocean itself.***

    - If that is too ambitious a project, can we find ***in these surface cracks,*** all the ***signs of organic molecules*** **we need to answer this question?**

    - If we drilled through the ice, might we find **pockets of "air"** ("***atmosphere***") ***of any kind***, below the ice, in spots where the ice is thinnest?

  - **Why does NASA depart from its very mission, and dare to leave these many questions unanswered? *Probes above the surface are not enough, and NASA leaders are not so stupid as not to realize that, but will only send Europa orbiter missions*.**

- The cost of such missions is the likely deterrent, but ***the importance of what we might find is so sky high as to make financial issues immaterial***.

- **We need to land probes on the ice, examine what chemicals, inorganic or organic, that color the ice, then lower probes through drilled holes in the thick ice crust to find out what "goes on" in that ocean.** ***An ambitious project? Of course, but that's how we got from caveman times to where we are now.***
  Why fall backwards in our exploration goals?

- **If we were to find life in Europa's ocean,** *since similar moons could be found around gas giant planets around "Suns" of all types, even around Brown Dwarf stars, then it will be clear that* "**Europanoid type life forms" could be far more common in the universe than the life forms we find on Earth, culminating in intelligent, ever curious hominids like ourselves,** ***(including dumbos who consider money as more important than knowledge)*****.**

- **Is it not our mission as the nearest intelligent species √** ***when life cannot start up on its own, to spread whatever kinds of life that have had a chance to survive, evolve, and thrive into our spacefaring times?***

- **What about worlds, if any, where primeval life has gotten on a wrong track?** What would be "a wrong track"? After all, if new life adapts to the existing environment, that is all we can expect, is it not?

When & where should humans go after Mars & Europa? Our 2 picks:

√ Saturn's largest moon Titan, where we might also find life forms totally different from those on Earth, even in Earth's oceans? Nor anywhere else.

√ The asteroid Vesta with zero-g conditions deep inside at its gravitational center, if hollowed out via a tunnel from the surface, we would have a unique place for all sorts of Physics experiments, in "a negative zero g" environment so to speak.

√ The orbit of asteroid Pallas takes this fair sized asteroid high above, then deep below the plane of the rest of the planets around the Sun, **instruments on Pallas could study both the Sun's polar areas, North & South, at the highest & lowest parts of its orbit.**

What would pioneers do for Christmas trees on other worlds?

√ Decorated pipe/wire framework?

√ Twice a Mars year? (once each "chron," (half a Mars year close to an Earth year in length). Martian pioneers might number their ages by chrons, for birthdays and anniversaries etc.)

√ Decorations on home front doors? Inside and out? On Living Walls and Living Wall room dividers?

Why not *even on miniature Bonsai trees?* (sample >) On tree shaped ornament holders? Inverted tree shape (wide at top etc.)? All of the above? We humans are very versatile. It's in our nature. We will find many ways - and when - to take a break, relax, ***and celebrate.*** ***"Jingle Bells! Jingle Bells! Santa's here!"***

Settlers will try many ways to celebrate the holidays. Over time, many, if not most of these ways could become common. Moon & Mars settlers will "get it on!" ##

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WHY we NEED to SETTLE both the MOON & MARS *& BEYOND*

#1) Basalt items (cast, carved, & fiber) bound for Mars at shipping costs far cheaper to send from the Moon, than from Earth's Surface, and the experience and "Know how" acquired by "Lunans" will be most helpful.

Basalt will be the *"iron,"* the *"wood,"* and the *"cotton"* substitutes on the Moon, Mars, and worlds beyond.

#2) Experience gained by Lunans in conserving used water will be invaluable

#3) The Moon is the least expensive source of nuclear fuel [Uranium 233 produced from Lunar Thorium] that would allow spaceships bound for Mars to get there in a fraction of the time it would take by burning non-nuclear fuels produced on Earth.

#4) The experiences had on the Moon, will be invaluable **to settlers of Mars, keeping both settlement efforts from heading down *dead end paths*.**

#5) Earnings from exports from the Moon sent to Mars, will reduce the expense of items needed on the Moon, that can be produced on Mars *and vice versa*.

√ **Settling both the Moon *and* Mars *must be Earth's Goals***, with "the motion seconded" by pioneers on both new worlds.

√ **The pioneer cultures that will bloom on both the Moon and Mars** will **re-invigorate cultures here on Earth.** It's **a no lose "Win" for all three worlds.**

√ And in time, the lessons learned on the Moon and Mars will be invaluable for those heading for new homes elsewhere in the Solar Systems, on [Pluto-Charon & larger asteroids [Ceres, Pallas, Vesta], or on around some of the larger moons of the gas giant planets, Jupiter, Saturn, Uranus, and Neptune].

Not to forget Space Settlements and two inner planets Mercury and Venus, all these locations may have "human futures" that will blow your minds. ##

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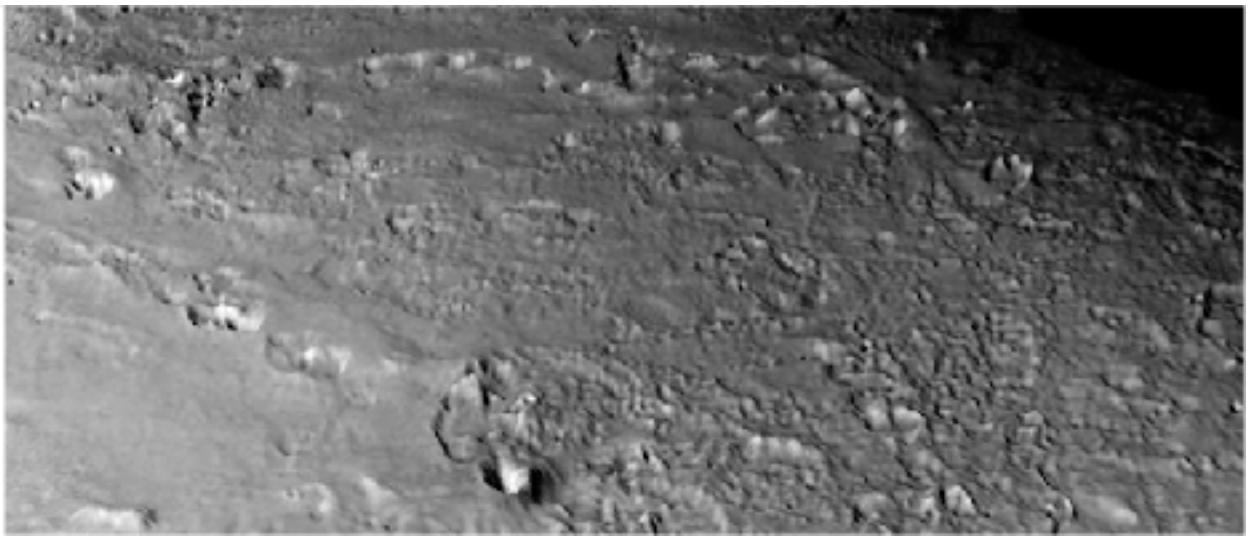
Which pets will do better on the Moon and/or on Mars?
What are your thoughts? Dogs? Cats? Birds? Monkeys?
Tell us why? Please send us your entries by February 1st, 2020
To kokhmmm@aol.com *(a 98% dog man, but will be interested in all your suggestions!)*

Photo taken by. **NASA's Voyager 1 probe** passing over Neptune's largest moon, **Triton**



Notice the bottle of wine (with white label) in one of the craters near the bottom of this photo. If that crater is miles across, the size of the bottle indicates it was left their by a visiting "god" **:)**

Notice too the series of bright spots, in what appears to be the outline of a heart. Might they may be something like "landing field guidance lights."

Your suggestion of what they mean are welcome.Mail to kokhmmm@aol.com **"April 1st Report"** - Entries April 2nd or after, will be considered for next year's contest in 2020.

Resources: https://en.wikipedia.org/wiki/Exploration_of_Neptune (and its moon, **Triton**)

(https://www.nasa.gov/mission_pages/voyager/pia12184.html

*Also needed **before next April 1st** are mission plans that would take **a highly insulated manned probe within a million miles of the Sun**, where around the Sun, at its equator, or over its poles or elsewhere, will be considered,*
and do tell us if you would like to be aboard and if so, why? **:)**
LOL!

Back to "dirty hands" Reality
Redesigning Space Settlements to include neglected features, because they were designed by people who obviously never "worked" in the real world.

1) ***Factories should run 24 hours a day, either with two 12 hour shifts, night & day, 3 days on, 4 days off one week, 4 days on, 3 days off the following week***
2) *Or,* ***three 8 hour shifts each day, and sometimes weekends for higher pay.***
3) *Why? I worked for many years in a (**beer** and **soda**) can company, **National Can**, that needed to run 24 hours a day, 7 days a week, and for the benefit of the workers involved, tried such a schedule (**#1 above**). Most of us loved it, including me.*

It is obvious that the original "architects" of "Space Settlements" had never worked in a factory before that had to run 24 hours a day, 7 days a week, getting their hands dirty to keep labor costs & product prices down,"worker satisfaction" up.

There was a cost. The presses where extremely loud, and even though I faithfully wore "ear plugs," I have since had a constant ear ringing noise, loud enough that I cannot enjoy music anymore. But the money earned bought me a home, now fully paid for (just utility bills) and in general, a very satisfying life.

Friends and visitors (and my dogs) do not hear that ringing in their ears, of course. (If I were to awaken some morning and not hear that ringing, I would know that I have died and made it to heaven! LOL!) #

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Would you retire to either the Moon or Mars if the opportunity came up?
If "yes!", tell us where and why and how you would spend your retirement days
***Email to* kokhmmm@aol.com**
*Letter title **"My retirement days on _____"***

You may also take the opportunity to tell us what space topics you would like to read more about in upcoming issues of Outbound.

(By the way, I (Peter Kokh) am 82** (as of 12/11) **and counting._

Contributed articles to Outbound are welcome, as well as an offer to Fill and Edit a future edition of Outbound, without committing to continue and take over, though that would be welcome also.
Even if someone does offer to take over, I will probably contribute articles as long as I remain alive and healthy. For me it is not work, but a pastime I enjoy!

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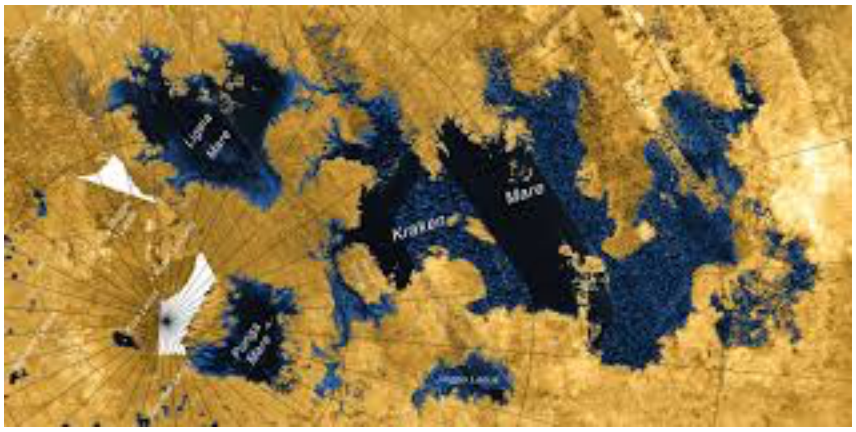
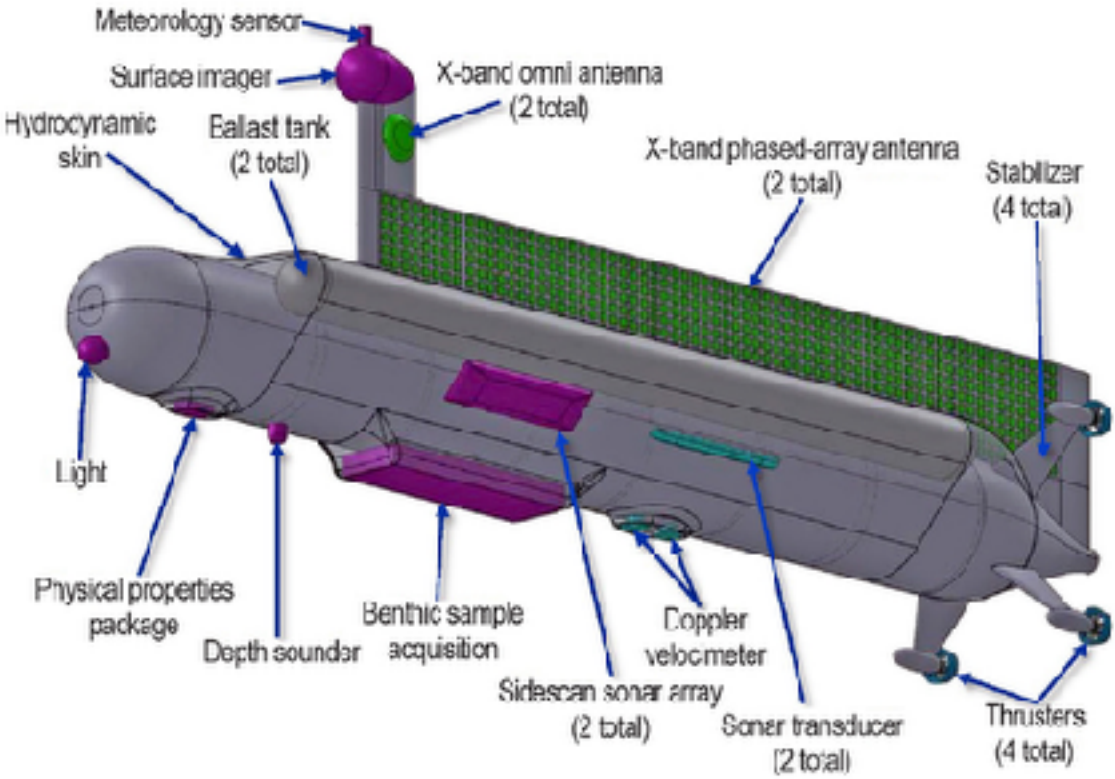
NASA Experts are considering various designs for a "submarine" to poke under the surface of Titan's "Great Lakes" of a liquid that is not water, as it remains liquid a couple hundred degrees below zero ***(Celsius or Fahrenheit makes little difference)???????***
[https://www.astrobio.net/titan/titans-great-lakes/]



These lakes have a total surface area the size of North America's Great Lakes
These Lakes are not full of water, but full of liquid Methane **CH_4,**
(liquid below -258.7°F (-161.5°C) . & ***Ethane*** **C_2H_6 (liquid below -128°)**
There are some Titan Submarine designs (none yet built, or sent to Titan)

A submarine designed and build to move and explore these extremely cold lakes of Liquid Methane and Liquid Ethane, able to map the lake bottoms, and be alert for anything that moves - the likelihood of creatures who could live in such liquids at such very low temperatures, seems Science-Fictional to us, but ***"Nature" is not bound to our imagination or understanding.***

We don't have to travel light years to another sun-like star to find such alien life forms. Titan is as alien an environment and be possible of such alien living ecology, and living creatures. We cannot yet imagine what we may find. ##



Above, one of several submarines designs for Titan's Great Lakes:
For more designs, simple Google "<u>Submarines for Titan's Great Lakes</u>"

If we were to find truly "alien" life forms on Titan, no matter how primitive, we will infect have visited an "alien planet" with "alien life forms" without having to spend a generation or more traveling to a distant star known to have planets, in spacecraft we can not yet design much less engineer.

But TITAN is not the only "alien, possibly life hosting, world in our Solar System. <u>EUROPA may or may not also be an alien life bearing world.</u>
<u>We need not invent spacecraft to take us to other stars in search of alien life systems.</u>

That puts further intensive exploration of alien life environments at the top of our list. We need more experts supporting future NASA Directions.

It's time to switch from "Interstellar journeys" to exploring two possible quite alien life forms <u>in our very own *"possibly shared"* Solar System</u>. ##

(I envy the younger generation for what they might explore and find out about, and explore, things we can only wonder about. But meanwhile, there is much in our very own Solar System that we have yet to discover, not only on other planets and moons, but even in our own "home planet.")

Perhaps you will be one of the explorers to find something unique! PK