

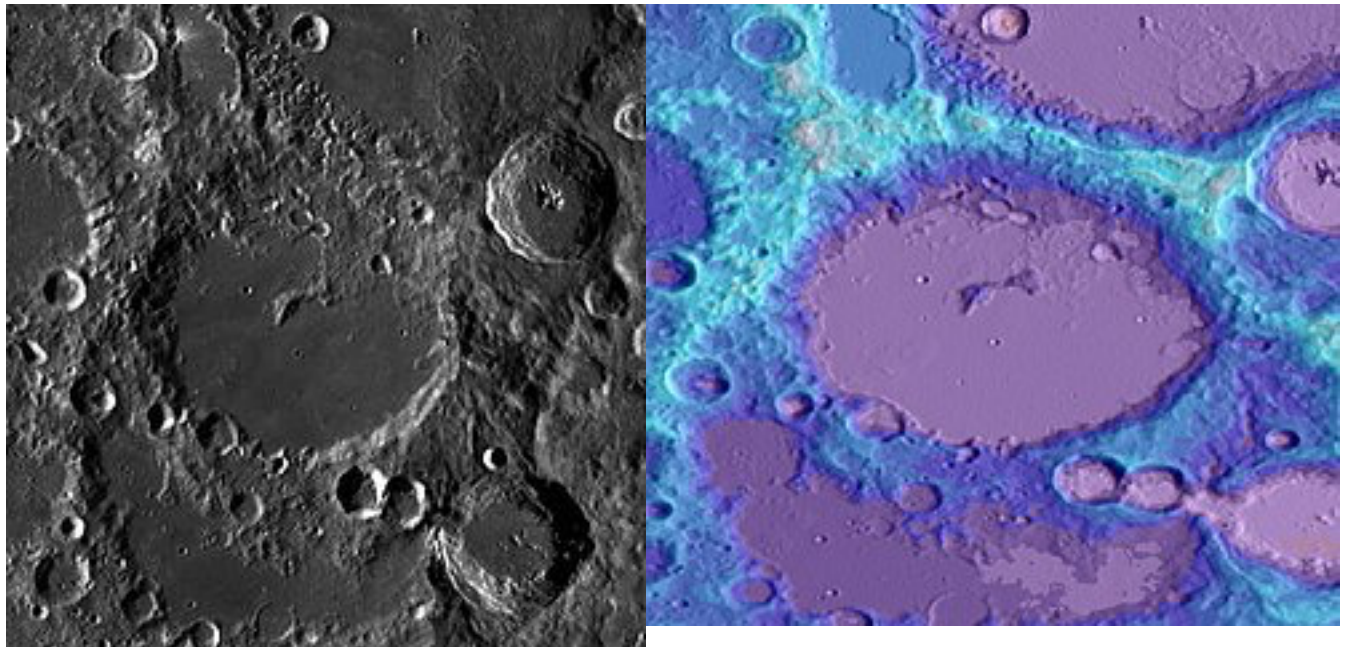
[A publication of the Milwaukee Lunar Reclamation Society,
a chapter of the National Space Society and of the Moon Society]

OUTBOUND #15 APRIL, 2019

China's Lunar Farside Lander, Chang'e-4 - watch it land (wow!)

>>> https://mashable.com/video/change-4-moon-landing/#D_Wd3PeeBaqh <<<

A "first" because both NASA & the US Congress seem to have lost all interest.
Something we could have done long ago, a mission that would not have been that expensive.



Chang'2-4 landed in [Von Kármán crater](#), located on the lunar far side within the [South Pole-Aitken basin](#). A mission that makes us wonder if we have erred by putting all our eggs in 2 baskets = NASA & Congress!

https://en.wikipedia.org/wiki/South_Pole-Aitken_basin



(dark blotch near the south pole, on the farside)
The **South Pole–Aitken basin** is an **impact crater** on the **far side of the Moon**. At roughly 2,500 km (1,600 mi) in diameter and 13 km (8.1 mi) deep, it is one of the largest known impact craters in the Solar System. It is the largest, oldest, and deepest **basin** recognized on the **Moon**.

It was named for two features on opposing sides: *the crater Aitken on the northern end and the lunar south pole at the other end*. The outer rim of this basin can be seen from Earth as a huge chain of **mountains** located on the Moon's southern limb, sometimes informally called "Leibnitz mountains."

Here's hoping that Chang'e-4 makes some unexpected finds

[From Wikipedia] "The South Pole–Aitken basin is **the largest, deepest and oldest basin recognized on the Moon**.^[1] The lowest elevations of the Moon (about −6000 m) are located within the South Pole–Aitken basin, and the highest peaks (about +8000 m) are found on this basin's north-eastern rim, which are sometimes called the Leibnitz Mountains.^[6] *Because of this basin's great size, the crust at this locale is expected to be thinner than typical as a result of the large amount of material that was excavated due to an impact.* Crustal thickness maps constructed using the Moon's topography and gravity field imply *a thickness of about 30 km beneath the floor of this basin, in comparison to 60–80 km around it and the global average of about 50 km.*^[7]

"The composition of the basin, as estimated from the *Galileo*, *Clementine*, and *Lunar Prospector* missions, appears to be different from typical highland regions. Most importantly, *none of the samples obtained from the American Apollo and Russian Luna missions, nor the handful of identified lunar meteorites, have comparable compositions.* The orbital data indicate that the floor of the basin has slightly elevated abundances of iron, titanium, and thorium. In terms of mineralogy, the basin floor is much richer in **clinopyroxene** and **orthopyroxene** than the surrounding highlands, which are largely **anorthositic**.^[8]

Several possibilities exist for this distinctive chemical signature: one is that it might simply represent lower crustal materials that are somewhat more rich in iron, titanium and thorium than the upper crust; another is that the composition reflects the widespread distribution of ponds of iron-rich **basalts**, similar to those that make up the **lunar maria**; alternatively, the rocks in the basin could contain a component from the lunar mantle if the basin excavated all the way through the crust; and, finally, it is possible that a large portion of the lunar surface surrounding the basin was melted during the impact event, and differentiation of this impact melt sheet could have given rise to additional geochemical anomalies. Complicating the matter is the possibility that several processes have contributed to the basin's anomalous geochemical

signature. Ultimately, the origin of the anomalous composition of the basin is not known with certainty and will likely require a sample return mission to determine.”

[Editor: in short, *Chang’e 4 is likely to greatly improve our knowledge of the Moon and of its surface. Kudos for China!*]

NASA has had a strong interest in the Moon’s far side, and in particular in the South Pole-Aitken Basin, but that interest hasn’t given birth to any landing probes.

(Should the blame fall on the U.S. Congress?) (Below, a suggested NASA probe)

<http://solarsystem.nasa.gov/galleries/south-pole-aitken-basin-sample-return> ([image link](#))

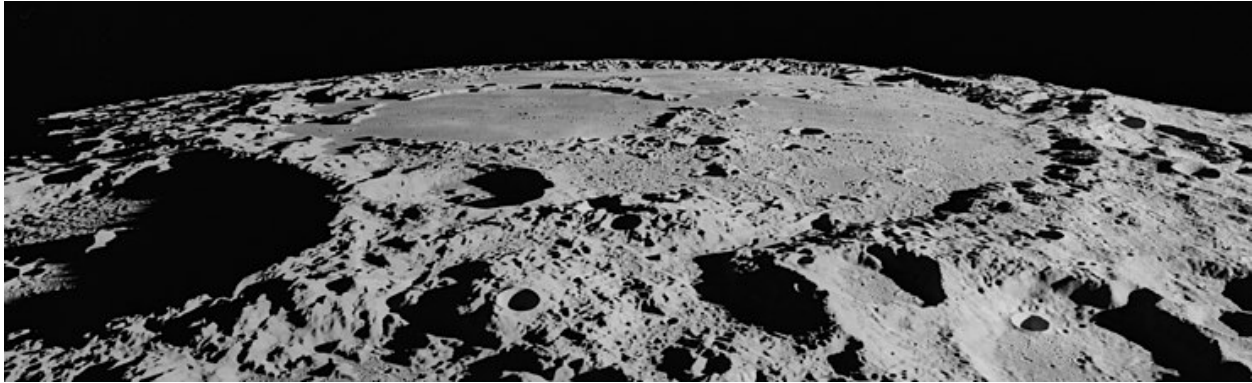
"South Pole-Aitken Basin Sample Return"

This mission would use robotic technology to gather samples from the Moon's South Pole-Aitken Basin and return them to Earth for study. The Aitken Basin, a massive impact crater on the Moon's far side, *may provide access to samples of the lunar mantle*, which could give scientists insight into the period of heavy bombardment early in our solar system's history. That should put such a sample return mission near the top of the list. #



Mare Ingenii ("sea of cleverness") is one of the few lunar “mare” features on the [far side](#) of the Moon. The mare sits in the Ingenii basin, which is of the [Pre-Nectarian](#) epoch, which lies in turn **in the outer part of the older and much larger South Pole–Aitken basin.**

The mare material located in Ingenii and the surrounding craters is of the [Upper Imbrian](#) epoch. The dark circular feature which dominates this mare is the crater [Thomson](#) (112 km diameter), with the overflow from Ingenii/Thomson directly to the east. Mare Ingenii is incompletely and thinly covered over much of its expanse with mare lava sheets.



There is no other place on the Moon that is as free of radiation as is this mare. That means, that tourists can spend more time “out-vac” without exposure damage.

Physicists believe that this radiation-freedom is the result of the antipodal (*other side of the Moon on a line passing thru the Moon's core*) powerful hit that formed the **Mare Imbrium** nearside impact basin (just to the south of Mare Frigoris.) The furrowed crater walls of the basin (and possibly those of **Van de Graaff** crater) may have been caused by focused seismic waves resulting from the Imbrium impact.

Here, tourists can spend much more time out on the surface without exposure to cosmic radiation, that is, *in out-vac sports that can't be enjoyed anywhere else on the Moon.*

Thomson crater would be an ideal place to put the most powerful radio telescope **array** ever made. We can only wonder what significant things they might find out about our galaxy and beyond, about our universe. *Here, at such a facility, we are more likely (than at any facility on Earth) to one day find clues about other civilizations on planets around other suns.)*

Even though vast light year distances would make interstellar conversation impossible, such a finding would be the greatest discovery of all time. Currently, we can only surmise, from our own existence, that there must be an untold number of other civilizations out there among the stars, some less advanced, some more advanced than our own, but all at light “year” distances that make “con”versation quite impossible.

I do believe that most, if not all, other civilizations out there, will have adopted their version of the Star Trek film's version of “**The Prime Directive**” (also known as **Starfleet General Order 1**), and the “**non-interference directive**”) a guiding principle prohibiting its members from interfering with the internal and natural development of alien civilizations.”

We need a pair of landers around the Moon's nearside Eastern & Western edges, that can send us live visions of the heavens, especially of the Milky Way, as a *live* computer screen backdrop, and with a brilliance that we could never enjoy from here on Earth through our thick atmosphere, especially uplit as it is by city lights.



Unfortunately, China's far side probe is not equipped to do that.

But perhaps, such a live vision of the universe with a brilliance and details such as no one of us here on Earth have never seen, will get more of us to stop thinking of the universe as just a painted backdrop for Earth. No matter how rare other inhabited "Earths" may be, in our universe at large, there must be zillions of them. More, there may be an infinite number of universes!

For more images of the Milky Way,

Just go to google.com and type in "Milky Way."

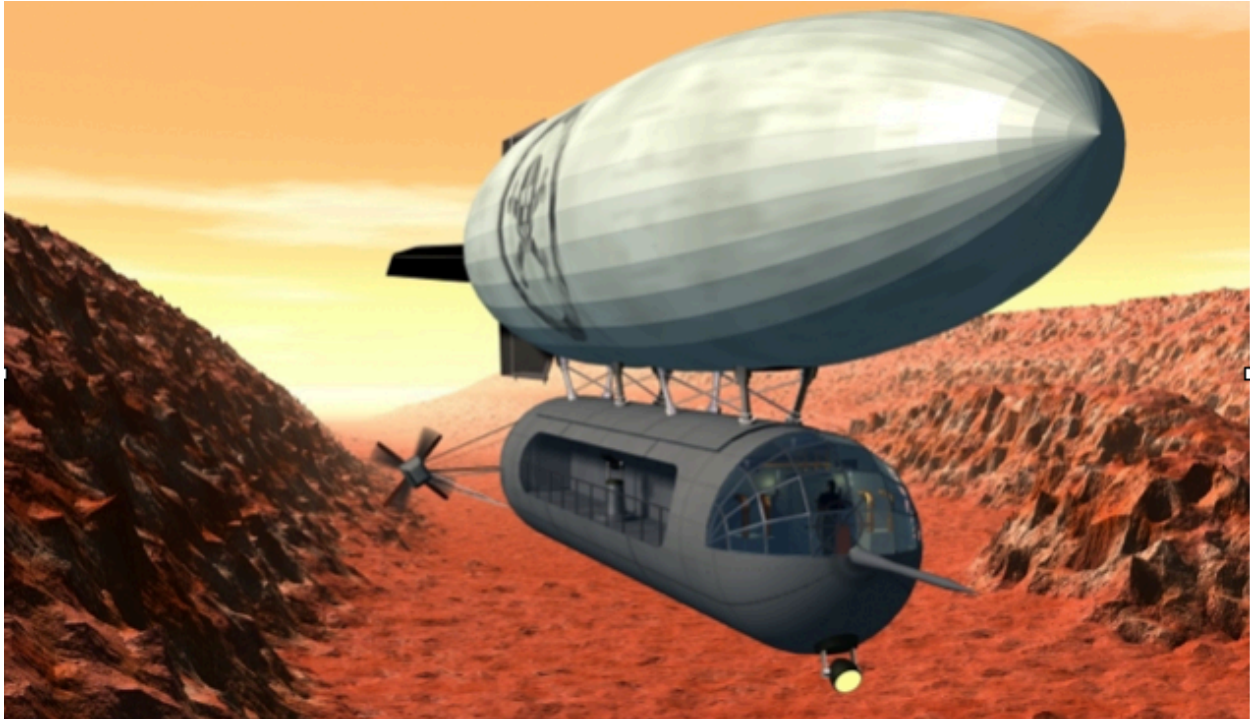
[Keep in mind that our Solar System lies **within** the Milky Way galaxy, so that what we see in the sky above us is just a part part of our galaxy, the portion, that lies to one side, until 6 months from now.]

Those of us in Earth's northern hemisphere can also see the spectacle of the **Andromeda galaxy**, somewhat bigger than ours, and the nearest to us, visible with the naked eye from places far from city lights. The Milky Way galaxy and the Andromeda galaxy are slowly drifting towards each other, and should meet, and mutually intersperse at an angle, some 6 million years from now (a very recent recalculation, the previous estimate being 4 million years from now.)

It would seem *unlikely*, that this passage would be "catastrophic" for inhabited worlds in either galaxy. It is possible that our galaxy has been through such an event previously. #

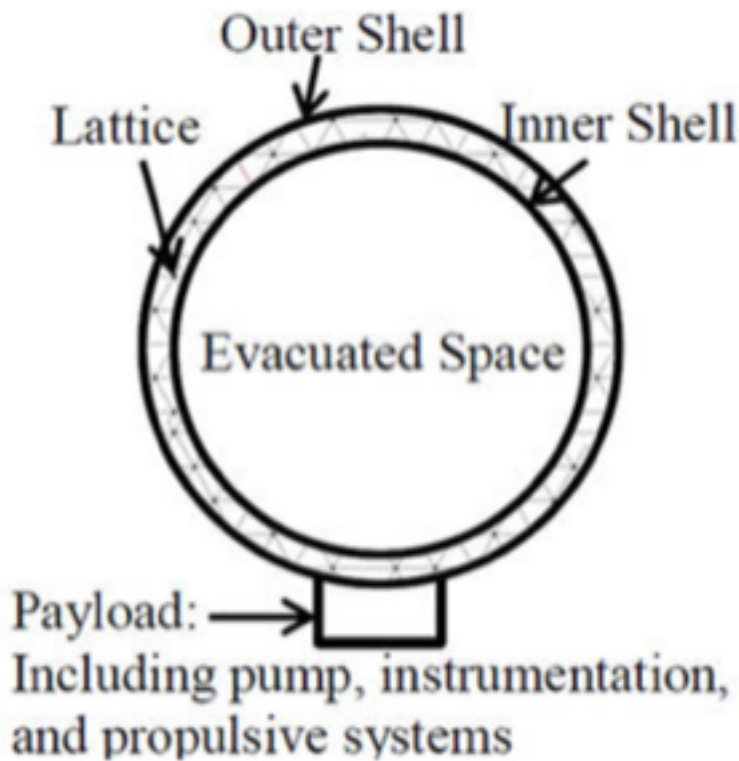
A better substitute for a Dirigible on Mars

A Dirigible inflated with hydrogen may not fly well on Mars, adding the weight of the structure to the weight of the gas inside, plus the weight of a crew and passenger structure. But there is an option, a metal structure and envelope with no gas inside at all.



Above: 2 suggested designs for Martian Dirigibles

In Outbound #12, we put forth another idea, a vehicle with just vacuum inside, thus weighing less, and buoyed to greater heights. [see next page]



Above: A

closer look at the Lattice that keeps the structure shape with no air inside.

How fast could such a ball-shaped structure “speed” through Mars’ thin atmosphere?

Would a “football shape” work? Why not!

✓ *In this design, the “hull” is two shells, held apart and in shape by a lattice between them. The lattice could be made of steel, or aluminum, or basalt fiber rebar.*

✓ *This craft has more lift than a dirigible*

filled with hydrogen, for example.

✓ *The Payload box could include room for passengers and minimum cargo.*

✓ *In front of that would be the “cockpit” - housing the crew flying the craft.*

✓ *This is one way to explore Mars from not far above, much closer than from orbit above the atmosphere. How does it maintain a set desired elevation above the surface? How does it land? We have not found such information.*

✓ *Such a craft could roam close above Mars’ northern ocean-sized basin, looking for signs of former shorelines indicating that there was indeed (or was not) an ocean on Mars in eons past.*

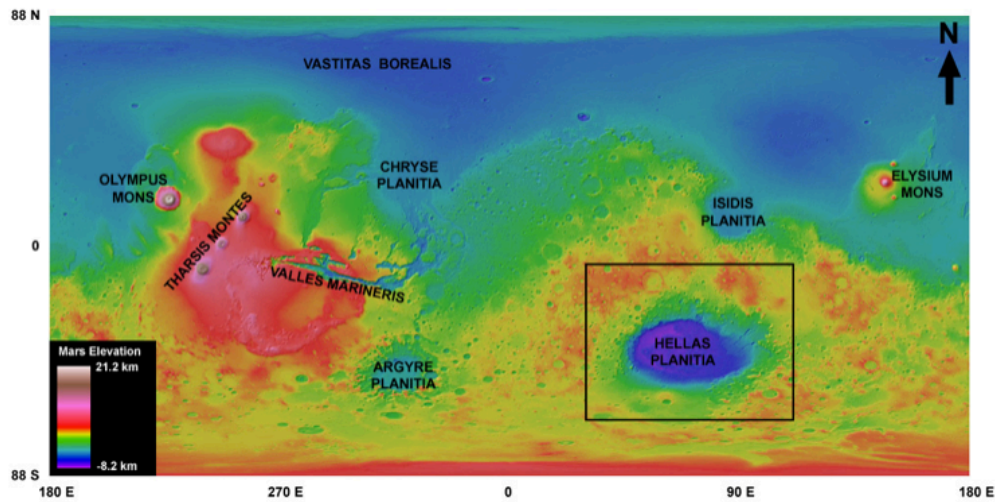
If and when there are spaceships making round trips to Mars and back, their customers will be ✓ officials from space agencies (and governments) on Earth, and ✓ **“Working Tourists from Earth who can earn up to half their fare to Mars refunded as well as a free ride home by**

✓ Searching the vast **Northern Basin** for signs of “beaches” and “beach debris” [in Valles Marineris and on the great volcanoes] ✓ **Blazing ridge trails and trails to lower levels,** ✓ **deploying signs,** ✓ **finding best spots for hotels,** ✓ **suggesting names for prominent features, etc.**

Elsewhere on Mars

- > Blazing roads for buss coaches, laying tracks for trains, building bridges - tackling obstacles
- > Writing articles for publications back on Earth and on the Moon. ##

“Heavier than air” Aviation on Mars (as opposed to dirigibles etc. and if “engineerable”) will begin within Mars’ Hellas basin



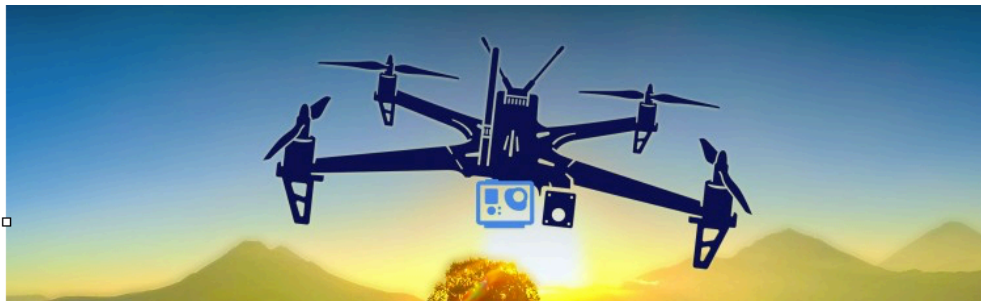
Hellas Planitia is a plain located within the huge, roughly circular impact basin Hellas located in the southern hemisphere of the planet Mars. Hellas is the third or fourth largest impact crater and the largest visible impact crater known in the Solar System. [Wikipedia](#)

Depth: 7,152 m (23,465 ft) **Diameter:** 2,300 km (1,400 mi)

History: NASA had boasted that it would build a(n) heavier than (Mars) air plane that would make its first flight on the 100th anniversary of the first flight by the Wright Brothers in 1903. *It never happened. No “excuses” - just silence.*

Well, when it does belatedly happen, the site will almost certainly be within the Hellas basin, where the air pressure of Mars atmosphere is at its highest.

And the chosen “air craft” is more likely to be like our current mini “**drones**” [e.g. image below] than something the Wright Brothers would have built. Why, because most conventional designs would likely fail, to NASA’s embarrassment.



But when an air craft of whatever shape, lift, and propulsion systems, large enough, and buoyant enough to carry a human crew, it is more likely to be a “lighter than Mars air” craft. ## (See article on Dirigibles and other lighter than “Mars air” options above.)

Space Conferences 2019

**The National Space Society's annual
International Space Development Conference
Arlington, VA - Thursday-Sunday, June 6-9, 2019
[across the Potomac River from Washington, DC]
[900 S Orme St, Arlington, VA 22204. Phone: (703) 521-1900]**

The Arlington Pentagon Sheraton is located on a hill with a beautiful view of Washington, D.C. NASA and many aerospace firms are headquartered in the D.C. area, where decisions get made that impact national, global, and outer space issues.

NSS and our ISDCs® have an influence on space policy and our presence in D.C. [the **D**istrict of **C**olumbia] provides direct access.

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**International Mars Society Convention
Thursday-Sunday, October 17-20, 2019
University of Southern California (USC Hotel), Los Angeles, CA
3540 S. Figueroa Street, zip 90007**

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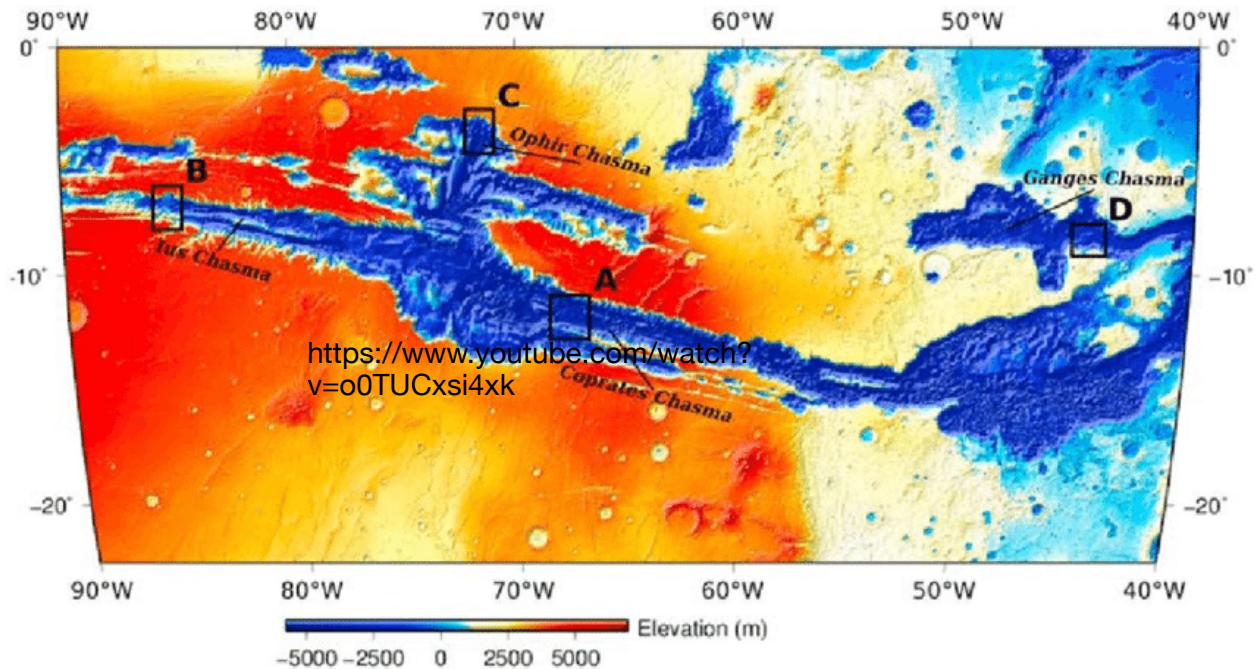
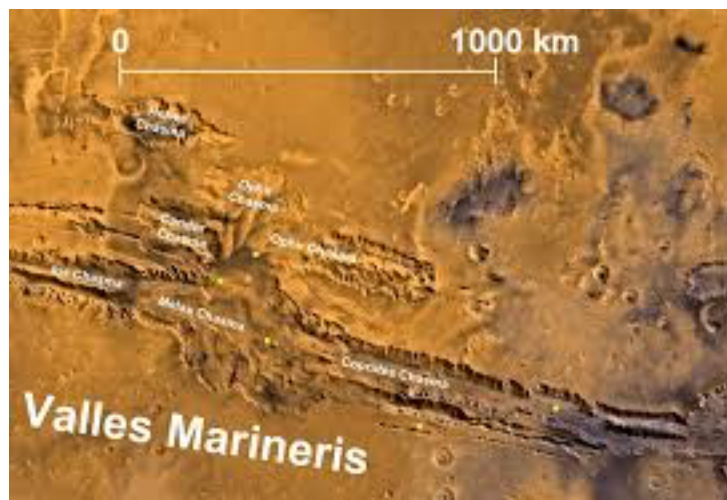
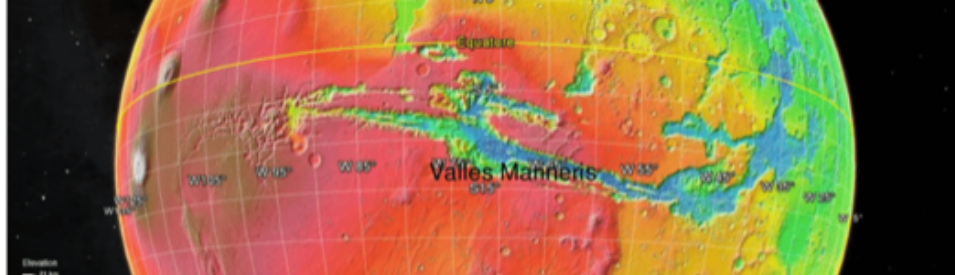
We hope to attend both conventions, this year
Especially if **Book 2** is at the Printer (Amazon):
“A Pioneer’s Guide to Living on Mars”

Then to follow with **Book 3**,
**“Beyond the Moon and Mars:
A Pioneer’s Guide to the Rest of the Solar System”**
(A collection of articles already in print in past issues of Moon Miners’ Manifesto)
Mercury, Venus, major asteroids: **Ceres, Vesta, Pallas**;
Jupiter (Callisto and Europa), Saturn (**Titan and Iapetus**),
Uranus, Neptune, and the “binary planet:” **Pluto-Charon**.
(It should follow shortly after Book 2, on Mars.) #

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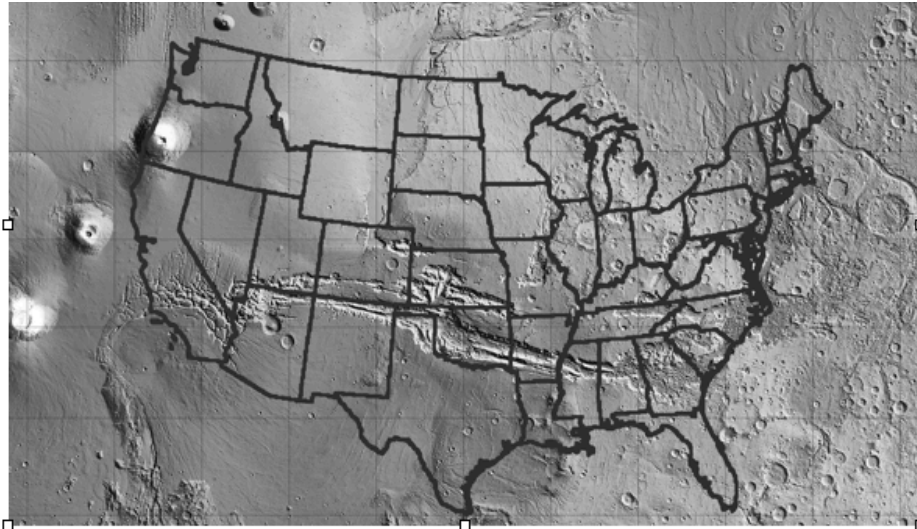
In Valles Marineris:

Visitor Chores establishing: ✓ safe trails, ✓ safe overlooks & trail signs, ✓ rest stops,
✓ hotels locattions, ✓ experienced guides ✓ best route through its western “delta”



<https://www.youtube.com/watch?v=o0TUCxsi4xk>

(Color Tour of MARS' Valles Marineris & It's Enormously Massive Glaciers)



Above: the size of Valles Marineris compared to the United States, from southern California to Georgia

The top Mars sites Visitors will pay to explore

(besides marking trails etc. in Valles Marineris)

- √ Find the best routes out of Valles Marineris *through its extensive “delta” into the “ocean basin” to the north*
- √ Find the best/easiest routes anywhere on Mars for bus coaches & trains & the best sites for settlements along those routes, avoiding any and all steep grades
- √ Find the best routes into and out of the Hellas Basin
- √ Find and explore intact lava tubes in Mars' largest volcanoes
- √ Help build an observatory on the crater rim of Pavonis Mons, on Mars' Equator
- √ Find any water flow “channels” in the Northern and Southern polar caps, when by late local spring, the Carbon Dioxide ice cap has evaporated, exposing the smaller Water Ice Cap below, and mapping those “channels” until they disappear, looking for any water borne debris
- √ Exploring the Great Northern Basin for any signs of “shores” and “beach debris”
meanwhile
- √ Bringing with them useful items (*clothing, appliances, pieces of art not available on Mars, and also movie films and photographs etc.*) all small in size and light in weight - *in exchange for souvenir items made on Mars, to bring back home to Earth or to the Moon. ##*

Will people from Northern subarctic climates make better Mars Pioneers?

Even the hardest of us may find Mars “**TOO COLD**”

Past less than popular frontiers

Not every frontier on Earth has been a clear success story. Many a frontier has proven less than popular, more challenging than its would-be pioneers were ready for, too unattractive to lure more than a scattering of pioneers, most of whom may have had no real idea of what they were getting themselves into. Consider these examples.

- **Siberia’s 6 million square miles of Taiga and Tundra** are easily the most populated of these frontier regions, but this has been achieved by very high incentives and considerable forced relocation. The region has 30 million people at the outside. It is much warmer, wetter, more fertile, verdant, full of wildlife, ready building materials (wood), and more resource-rich than Mars. So if it has taken a century to build its population to this point, at the end of a relatively short and easy journey from the friendlier more civilized and sophisticated western regions of historic Russia proper, what grounds does that give for a belief that we could see 50 million pioneers on Mars within a century of its opening?
- **Yukon & Northwest Territories:** Similar to much of Siberia, is Canada’s great Far North, with a combined size half that of the continental U.S. Again resource and life-rich, within 2 hours reach by air of Canada’s major cities, but after a century plus home to less than 50,000 hardy people. Major Canadian Arctic islands, like Baffin and Ellesmere, veritable Floridian oases by Martian standards, are populated mainly by prehardened Eskimos.
- **The Falkland Islands:** This haven of the South Atlantic, perennially disputed by Argentina and Britain (incumbent landlord) are treeless and wind-swept but have other vegetation and wildlife, and are surrounded by food-rich waters, and are much more “balmy” than Mars. After centuries, they are home to less than 5,000 souls.
- **South Georgia:** 800 miles SE of the Falklands, this thousand square mile isolated refuge from civilization is home to few humans, many rats.
- **Greenland:** apparently this greatest of Islands had green-clad shores fringing its glacial interior at the time of its discovery by vikings a millennium ago. True, 80% of this nominally Danish autonomous country is covered by a thick ice sheet. But the Montana-sized ice-free coastal areas boast only 60,000 heavily *import-dependent* citizens.
- **Spitzbergen:** in the no man’s sea between the North Atlantic and the Arctic Oceans, well to the north of the top of Norway who owns them, these islands, the size of West Virginia, are home to the most poleward (78°N) of real human settlements (i.e. excluding the family-free caricatures we see in the Antarctic), namely Longyearbyen with its “suburb” Barentsburg, counting together some 2,000 coal-mining pioneers, mostly from Russia. When’s the last (or first) time you saw a blurb appeal to help open the Spitzbergen frontier?
- Beat the rush! **Compared to Mars, Spitzbergen is a paradise!**
- **Antarctica’s shores and fringes:** By all salient characteristics and measures, only the night-day pattern is friendlier on Mars than in Antarctica. The temperature ranges and seasons are similar, except in length. Antarctica’s air is oxygen sweet, ready to breath through a warming filter. It’s winds pack more windmill-turning punch. It’s dry valleys sport lakes with algae life.

Birds abound. Its shore-washing waters are more abundantly teeming with food-fish and sea mammals than anywhere else on Earth. It has oil and coal and iron ore.

However remote by description and lore from the familiar rest of Earth, Antarctica is not that far away anymore. Base personnel are on the Internet and FAX lines, and the two dozen some outposts of several nationalities are all reachable within a couple of days through most of the year.

But there are no real settlers, no pioneer families. Treaty forbids this you say! Give me a break! If people wanted to go, they would. Since when have treaties not been made to be broken? — People don't want to go — in droves, in an eloquent unanimity by default - not to this god-blessed, spectacularly beautiful world-apart within our world, ***a place which viewed through equally untinted glasses is far richer and friendlier and more beckoning than Mars.***

The difference is this and this only:

When it comes to Antarctica, we are being honest,

When it come to Mars, we are still prisoners of romantic myths.

This sampling of not-so-popular frontiers gives little comfort or credence to those who expect hundreds, thousands, or millions to flock, Oklahoma style, to Mars once the planet is pronounced “open.”

Yes, some will volunteer, and actually go through with it, and work the Martian Frontier as if there were no return - for there may well be none. But ***those recruits who do not get cold feet at the last minute will be “the few, the proud, the Martians.” They’ll come mostly from already hardy subarctic and cold desert populations.***

Will they be enough to provide Mars with a critical mass for an isolated self-efficient economy? Maybe not.

The time to be personally honest is now.

II. Being Honest about the “Outdoors”

Few people other than agoraphobes do not love the outdoors on a fair, sun-glorious day. But some of us have a “soul”-need to spend significant quality time outdoors, hiking, driving, playing sports, or just relaxing on the front porch or rear deck. The rise of Television and the Internet has not quenched that thirst in all of us, only in some of the already mentally dead.

Then there is that fraction of the population who plunge into outdoor hobbies necessary for their sustained mental balance. Some of these “hobbies” we will be able to transplant to Mars, up to a point: √ motoring, √ hiking, √ rock collecting, even √ flying. Others, we can forget - at least until we can build cities or recreational parks within huge macro-structures that create modest “middoor” environments: √ sailing, √ bird watching, √ hunting, √ fishing, etc.

Most of these outlets for the soul will be unavailable to the early pioneer. As they are the ones who must come first, who must indeed “pioneer” and set up shop for the dreamt of Martian civilization to come, the question for Mars enthusiasts returns: “Am I being honest with myself? “Would enlisting mean sacrifices that over time I would find so unbearable as to unbalance me?”

Each of us must answer that question for him/herself.

The time to be personally honest is now.

III. Being Honest about the “Boondocks”

The outdoors isn't all that pioneers will be called upon to give up. Mars is a world physically large, its surface comparable to all Earth's continents together. But sociologically and

economically and opportunistically it will be a very, very small “world.” One or more really small towns where everyone knows everyone else, from which there is at first no change of human scenery.

Are you a city guy or gal, or a country one? Or (like me), someone who needs to spend time in both? could you handle being stuck in a small ultra rural hamlet the rest of your life with no more than time-delayed electronic access to the greater world of humankind? Even the most content farm boy likes to sample the big city lights once and a while.

Those of us who revel in the diversity of our World, “big W” (containing not only the cities, towns, cultures, nations, etc. but the plant and animal wildlife, etc.), may find “the little w” unbearable. Earth will no longer be, as on the Moon, “a TV or radio set on-off switch away” and available for a two week vacation for the price of a little exercise in the gym followed by a couple of days’ travel each way.

The new Martians will have only imported videos to remind them that there is/was more to the universe they have chosen to leave behind. On Mars, returning “home” could be as much as a two and a half year undertaking - one way.

We are used to a world where everyone does not know everyone else, where it takes more than a minute to read the days news, with an inexhaustible supply of strangers to meet, diverse rags to read, and of stores to shop.

Mars will be, at first, “the ultimate small town, all alone on a big super remote island.”

The time to be personally honest is now.

IV. Earth need not be the only source of Volunteers for Mars

In contrast, for established or native-born Lunans, Mars may have all the siren appeal of an Oasis. Lunans will already have weeded themselves out, √ have become accustomed to not being able to go outdoors without a space suit, √ and are used to spending their lives entirely in air-managed micro-environments, accustomed to the recreational tradeoffs they have had to make, accustomed to the “boondocks.” On the Moon, where such weeding out is a much less expensive proposition than it will be on Mars, a population will emerge that is well adjusted, creative of its own diversity, recreational and artistic opportunities, of its own diversions and “get-away” escapes, able to work the frontier free of paralyzing depression.

Some longtime and native-born Lunans will find themselves ready for a new challenge. To them, Mars will appeal as a veritable Mecca. The cold, the isolation, the restrictive living - all this will be either nothing new, or scarcely intimidating. There will be tradeoffs that they must face and accept in making the move. *Mars is physically and logistically and interactively two magnitudes (a hundred times) more remote from Earth. But balance this against the consequences and perks of a thin atmosphere, a little more gravity, freedom from the tyranny of a gray toned palette, a lot more carbon, nitrogen, hydrogen, and water, a more Earthlike pace of sunrise and sunset, a somewhat more relaxed lifestyle.*

Unlike people who have never been off Earth before, **Lunans** will come to Mars ready for the job, *experienced with the rough edges of the frontier, full of depression-resistant optimism and enthusiasm.* No Earth-born Earth-bound population offers to be as fertile a source of Martian pioneers, than will be already frontier-hardened Lunans.

Again, it is the pre-hardened Lunan pioneer, ready for fresh challenges, who will be able to handle such deprivations on Mars - he or she has already made them (or never experienced such activities) and survived in good psychological health. **Lunar Pioneers** of this future national background (dare we say it) *stand to be the born-leaders on the Martian frontier.*

If in impatient urgency, we attempt to open Mars before there are Lunans to help, we risk setting up history's most expensive ghost town(s).

That is we tempt failure, tempt it big time. "Pride goeth before the fall." Not to forget one of the most primary cosmic laws as it applies to the affairs of mortals: ***"Impatience always backfires"*** This consideration is in itself, a weighty reason for beginning lunar settlement first, whatever the timing for a first "flags and footprints" exploratory bravado mission to Mars, likely stands to be as much a false start as was Apollo, now more than half a century earlier.

The time to be personally honest, and to be honest as a space advocacy community, is now. For the National Space Society and its Board of Directors, It is time to return the pendulum to the center. Yes, we must open the Martian Frontier! - In sequence!

Granted, government[s] probably can do one or the other and not both. Let the government[s] concern themselves with Mars, after it[they] have set up a politico-economic regime and amply-incentivized rules of the game that will entice free market enterprise to open the Moon. ***Ultimately, only profits can open the frontier, and they are far, far likelier to come first (if not only) from the Moon. ##***