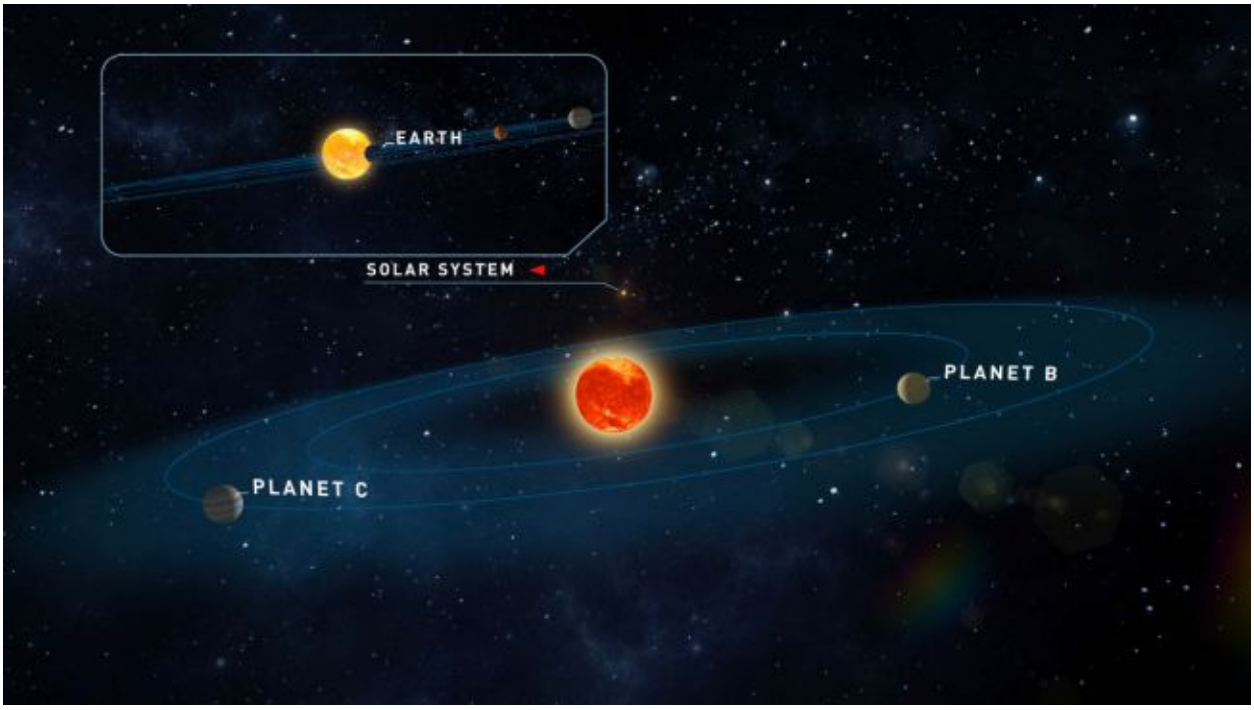
[A publication of the Milwaukee Lunar Reclamation Society, a chapter of the National Space Society & the Moon Society]

OUTBOUND #19 JULY 2019

Two Potentially Earth-Like Alien Planets Found Around Nearby Star

"There are even more potentially habitable planets near Earth than we ever imagined. A research team discovered two Earth-like planets in our cosmic backyard, and they're located in the perfect zone for water to form on their presumably rocky surfaces.



ABOVE: A diagram showing the arrangement of the two newly detected planets orbiting **Teegarden's Star.** (Image credit: Universität Göttingen)

"The planets orbit a sun known as "**Teegarden's Star**," **only 12.5 light-years from Earth**. (A light-year is the distance that light travels in a year, or roughly 6 trillion miles or 10 trillion kilometers.) The two planets look an awful lot like Earth and our neighboring worlds, the researchers said.

"**The two planets resemble the inner planets of our solar system**," lead author Mathias Zechmeister, a research scientist at the Institute for Astrophysics at the University of Göttingen in Germany, said in a statement. "**They are only slightly heavier than Earth and are located in the so-called habitable zone, where water can be present in liquid form.**"

The results were obtained as part of the CARMENES search for exoplanets; CARMENES stands for "**C**alar **A**lto high-**R**esolution search for M dwarfs with **E**xoearths with Near-infrared and optical **É**chelle **S**pectrographs."

According to that project's observations, the newly found worlds orbit their parent star with periods of roughly five days and 11 days, respectively. That's very quick compared to planets orbiting our own sun (even Mercury takes 88 days for a single circuit), but **Teegarden's Star** is an **M dwarf** — a type of star that produces less light and energy than our own Sun. Any potentially habitable worlds would be found huddled closer to this star than Earth is to the Sun, or their water would freeze. Thus, their orbits would be quicker.

More planets could be lurking in Teegarden's Star's solar system, the research team added, as many stars have more than a couple of planets orbiting them. The research team tried to find more evidence of planets using the "transit" method, which looks for subtle dips of brightness as a world passes in front of its star.

The scientists didn't detect any transits, but they did point out a coincidence of cosmic geometry: Any potential inhabitants on the newfound planets could use the transit method to see Earth. That's because from the vantage point of Teegarden's star, Earth orbits its sun at just the right angle to transit across the face of our star, allowing any astronomers "out there" to spot us as we pass by.

A paper based on the research was published in the journal Astronomy and Astrophysics. #

Related: Our Interstellar Neighbors: 5 Potentially Earth-Like Planets Nearby

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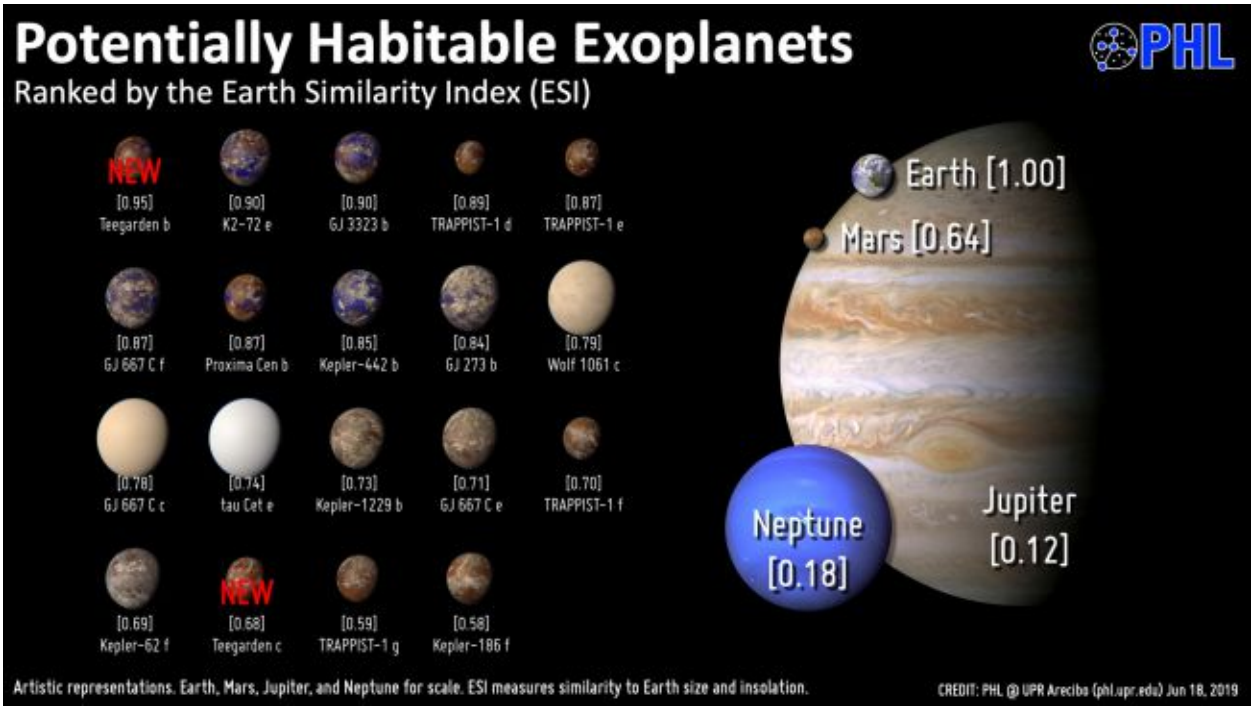
This year's **I**nternational **S**pace **D**evelopment **C**onference in Washington DC was a great success.

Next year's ISDC is expected to be in **Dallas, Texas Memorial Day Weekend, May 21-25.**

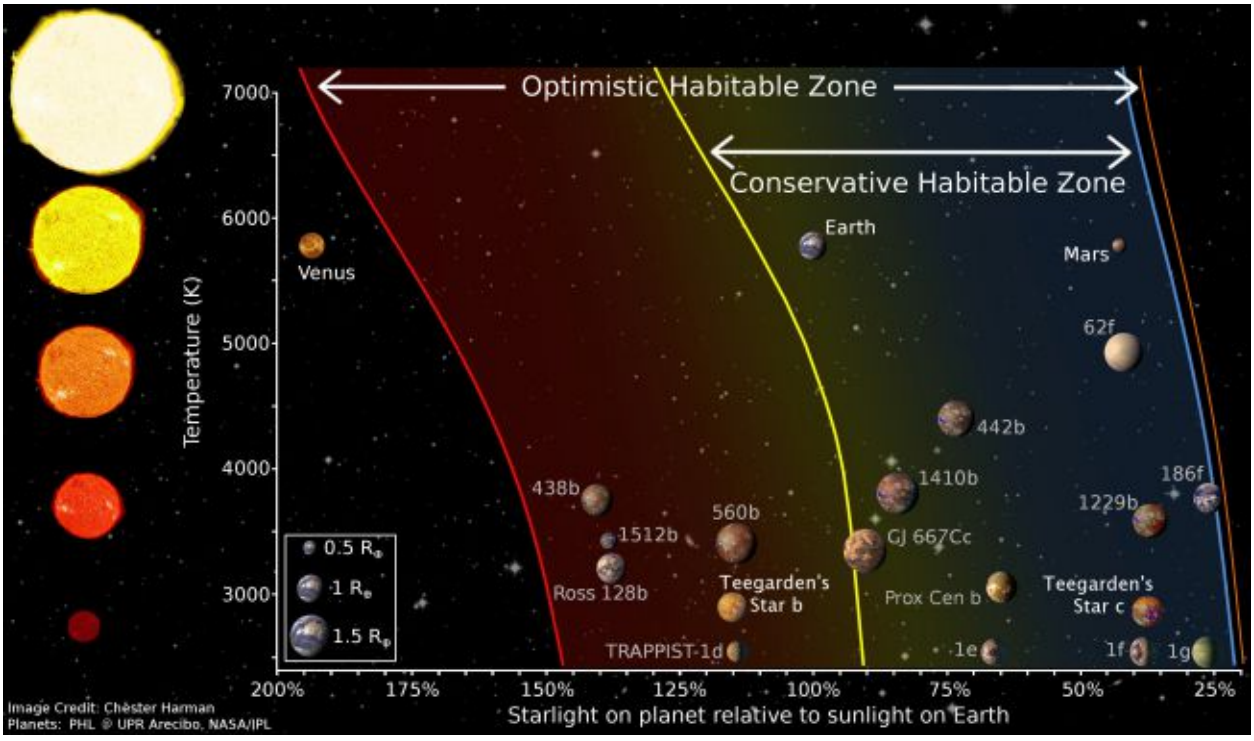
Coming up in October this year, will be the Mars Society Conference, in Los Angeles, at the UCLA campus downtown. We hope to make it there where I hope to present my next book,

"A Pioneer's Guide to Living on Mars" - Peter Kokh, kokhmmm@aol.com

This book will be as "revolutionary" as has been **"A Pioneer's Guide to Living on the Moon"**



This graphic (ABOVE) shows the top 19 potentially habitable planets as of June 2019, sorted from the most Earth-like to the least. (Image credit: A. Mendez (PHL)



This graphic (ABOVE) shows a comparison of the habitable zones of several alien planets, and how the Teegarden's Star planets measure up. This graphic shows the size of Teegarden's Star, as the orbits of its planets, as compared to the size of Earth's sun.

An artist's illustration to compare an Earth sunset with ones that could occur on the exoplanets Teegarden b and Teegarden c around Teegarden's Star 12.5 light-years from Earth. (Image credit: PHL/UPR Arecibo)

The results were obtained as part of the CARMENES search for exoplanets; CARMENES stands for "Calar Alto high-Resolution search for M dwarfs with Exoearths with Near-infrared and optical Échelle Spectrographs."

According to that project's observations, the newly found worlds orbit their parent star with periods of roughly five days and 11 days, respectively. (*Not much time for "seasons!*") That's very quick compared to planets orbiting our own sun (even Mercury takes 88 days for a single circuit), but Teegarden's star is an M dwarf — a type of star that produces much less light and energy than our sun. Any potentially habitable worlds would be found huddled closer to this star than Earth is to the sun, or their water would freeze. Thus, their orbits would be quicker. ###

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A paper based on the research was published in the journal Astronomy and Astrophysics.

- Two worlds discovered by NASA's Kepler Space Telescope have about the same density as a package of cotton candy. The two planets, which orbit a young star only about 500 million years old, are newborn worlds nearly as wide as gas giants, though they weigh in at less than 10 times the mass of Earth.

Using NASA's Hubble Space Telescope, researchers made follow-up observations of the two "delicious" worlds, known as Kepler-51b and Kepler-51d. They found that the bloated atmospheres of the worlds most likely contained a haze stretching high above their surface. The worlds' expanded atmospheres placed them in a rare class of exoplanets, the "super-puffs."

"These are the lowest-density exoplanets to date." Jessica Roberts presented the preliminary results during the 232nd semiannual meeting of the American Astronomical Society in Denver. A graduate student at the University of Colorado, Boulder, Roberts helped sleuth out an Earth-like comparison for the planets. She found an unusual analogue for the super-puffs — a sweet treat.

In the solar system, Saturn's largest moon, Titan, is the only one to be dominated by a haze layer made of hydrocarbons, most likely methane and ethane. The massive moon may provide insight into the super-puffs, which could bear an extended version of the haze.

"**We might be looking at some really fluffy Titans.**" ###

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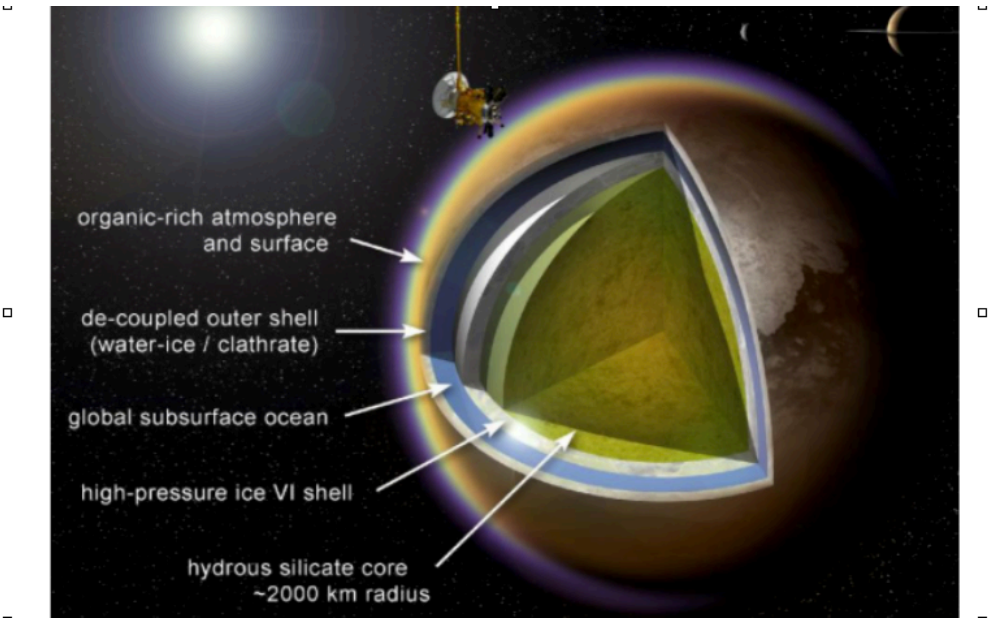
Proposed Orbiter Could Probe Ocean Beneath Saturn's moon Titan

https://www.space.com/37921-oceanus-orbiter-for-saturn-moon-titan.html

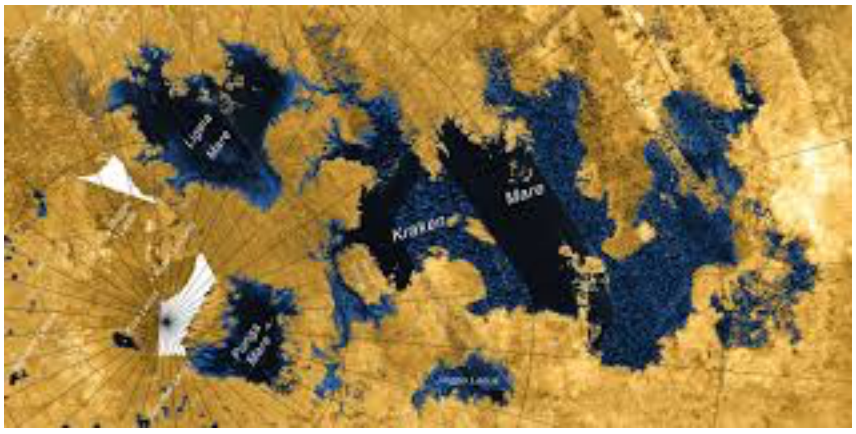


An icy shell separates Titan's organic-rich surface from its liquid ocean. If organic material manages to penetrate that shell and travel to the water beneath, it could provide the necessary ingredients for the evolution of life as we know it.

When NASA's Cassini mission arrived at Saturn, it pressed through the haze surrounding the ringed planet's largest moon, **Titan**, to reveal a complex, liquid-covered world with the potential to support life. … "It's a really fantastic world totally rich with organic chemistry, It looks like it might be an interesting place for life in the same vein as Europa and Enceladus.

The mission **"Oceanus"** was submitted as part of NASA's New Frontiers mission competition. (The **New Frontiers program** seeks to explore the solar system with frequent, medium-class spacecraft missions engaged in focused investigations.) In addition to the ocean worlds Titan, Europa, and Enceladus, the current round of proposed investigations features goals that include sample return from the moon or from comets, a study of Saturn or Venus, or a rendezvous with the Trojan asteroids of the outer solar system. By studying the organic material and landscape features, as well as capturing more detailed images, ***Oceanus would investigate the organic and methane cycle on Titan and probe what's going on beneath the surface.***

Titan boasts an intriguing surface, with organic-rich hazes and flowing liquids. With its liquid presence fueled by energy from the sun, the planet bears a strong resemblance to Earth. Instead of water, however, ***Titan's atmosphere and surface are dominated by methane and ethane***. The presence of these hydrocarbons in the upper atmosphere forms what Malaska called "a complex organic chemical factory," while it is ***the only solar system other than Earth to contain flowing lakes and rivers. Map of some of Titan's Lakes below, comparable to our "Great Lakes" along the American-Canadian border!***



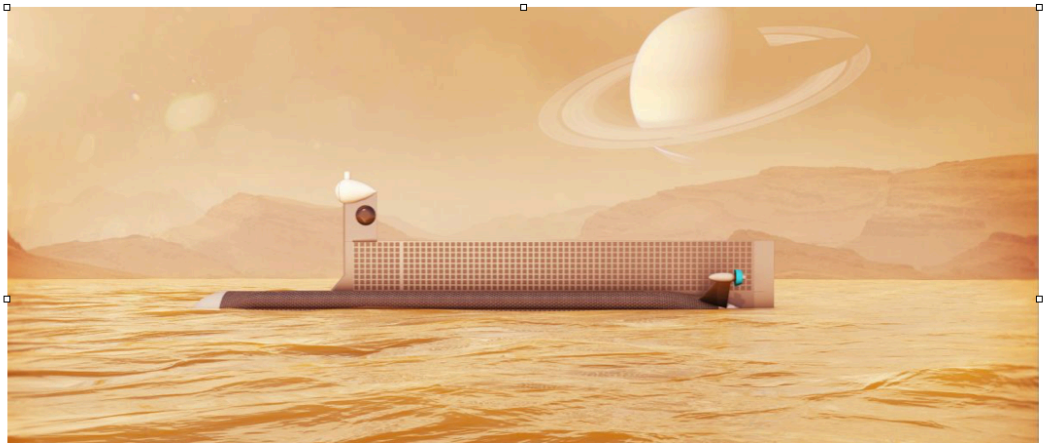
https://earthsky.org/space/scientists-find-new-surprises-about-titans-lakes

"The large ones are known as *maria* (seas) and the small ones as *lacus* (lakes). It's now known that Titan's **hydrologic cycle** is surprisingly similar to Earth's, with one big exception: the liquid on Titan is **liquid methane/ethane** instead of water, due to the extreme cold. The moon's northern hemisphere, in particular, has dozens of smaller lakes near its pole, and now scientists have found that they are **surprisingly deep** and sit **on the tops of hills and mesas**. These observations come from data collected during the last close flyby of Titan during the Cassini mission, which ended in 2017." ##.

(**We need to send some proposed submarines to explore these "lakes"!**) #

NASA is testing *an roobot Submarine to* Use in Titan's Seas. It Will Be Cool, *Very Cool! But it Won't Be Easy.*

https://futurism.com/nasa-space-submarine-titans-seas



NASA thinks Titan's "lakes" are a great place to look for extraterrestrial life.

While this might sound promising, some elements of Titan's makeup aren't exactly conducive for us to go there and find life. The rivers and lakes on Titan's surface, for example, also carry a lethal mixture of methane and ethane — not exactly something we would want to dive into headfirst.

That is, at least without the right equipment. NASA might be taking on the task. The agency is considering sending a craft the 1.4 billion kilometers (886 million miles) to Titan in 2025 and it is designing a submarine to plunge into its noxious seas.

Researchers from **Washington State University** (in Pulman, Washington) are helping NASA navigate some *very* uncharted waters. The team has announced that it will ***simulate Titan's hydrocarbon seas in a test chamber here on Earth.*** Inside the super-cold chamber, there will be ***methane-ethane rain and snow***, which the researchers will observe via a tiny camera. That footage will hopefully give them enough information to complete ***their other task: to engineer an autonomous submarine that could roam Titan's liquid surface.***

If we do find "life" in these seas, it will be of a kind we cannot yet imagine. (But we need to look for such alien life in Europa's ocean as well!) #

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Mark these dates on your first 2020 Calendars!

ISDC 2020 Dallas, Texas May 28-31, 2020 at Embassy Suites by Hilton

(The weekend after Memorial Day which falls on May 25th)

Mark the dates on your 2020 Calendar (*for now, **on the last page of your 2019 calendar***) and plan on attending! We hope to be there.

Mars Society Rolls Out New Web Site - July 2, 2019

http://www.marssociety.org/members-area-update

July 2nd was the day! The Mars Society has launched its new official web site! After months of hard work by a group of technical volunteers led by our IT Director James Burk, we are excited to roll out the new version of our organization's main web site, located at: www.marssociety.org.

As you will notice, visitors will have quicker and easier access to our web pages and content. ***Navigating our website just got a lot simpler!*** In addition to ***a new look***, the site is also the most technically clean and best-practices filled platform developed to date by the Mars Society.

Some of the new features include:

- **A new Featured Video section** which highlights important video content (such as our new *Mars Talk* podcast) and quick links to our 200+ annual convention videos on the Mars Society YouTube page.
- **New sub-page layouts** for content (e.g.: Dr. Zubrin's *Why Mars?* page) and news articles (e.g.: links under News & Announcements section).
- **More options for signing up for our email announcements & social media platforms.**
- All content throughout the site has been reviewed and updated with the latest information. Also all news bulletins since 2015 have been migrated over.
- **The site works on PC, Mac, mobile and other devices and form-factors such as tablets and iPad Pro.**
- The site has been tested on ***all modern and older browsers that have at least 1% market share of the Internet.***
- Additional features: √ tag cloud, √ social media integration, √ related articles and more!

This release represents the rollout of ***a new unified brand and design language across all of the Mars Society's web assets.*** We'll incorporate this design to our other project and task force web sites over the next 6-12 months, so that we will have a fully modernized and integrated web site infrastructure that can effectively provide outreach to our members and the general public.

As part of our new web site launch, ***we have temporarily disabled our Members Area to allow us to make some major upgrades to it.*** This revision is substantial and will offer ***several new features including*** https://spaceflightnow.com/2019/04/03/insight-scientists-not-sure-stalled-mars-heat-probe-can-be-recovered ***√enabling our members to self-manage/self-renew their membership and √ connect and share information with other members and their local chapter(s) instantly.***

Rest assured, all our Mars Society member information, including previous username, email address, member ID, chapter/location and all other profile details, has been archived and will be applied to their profiles on the new Members Area. **Also all content that was available on the previous Members Area is still online and can be found at:**

http://www.marssociety.org/members-area-update.

The Mars Society wishes to extend its gratitude to the many individuals who helped with this redesign, including Shawna Armstrong who created the initial UX design composites and style guide, and everyone who reviewed the test version and sent in bug reports.

We hope you will enjoy visiting our **updated web site**, and we welcome any feedback you may have (**info@marssociety.org**). Thank you, and, as always, ***On to Mars!***

The Mars Society
11111 West 8th Avenue, unit A
Lakewood, CO 80215 U.S.A.
www.marssociety.org - https://www.facebook.com/TheMarsSociety

Our Comment: *Why not resurrect the files of all past crews both at the Flashline Mars Arctic Research Station FMARS and all crews at the Mars Desert Research Station, MDRS? To those of us who have been on one or more crews at either station, this would mean a lot! And our reports will enthuse and challenge new crews at both stations. Thanks, Peter Kokh*

In the meantime, ***how about naming the first Mars Settlement, "New Lakewood?" (with a small lake and an island of trees at its center?)***

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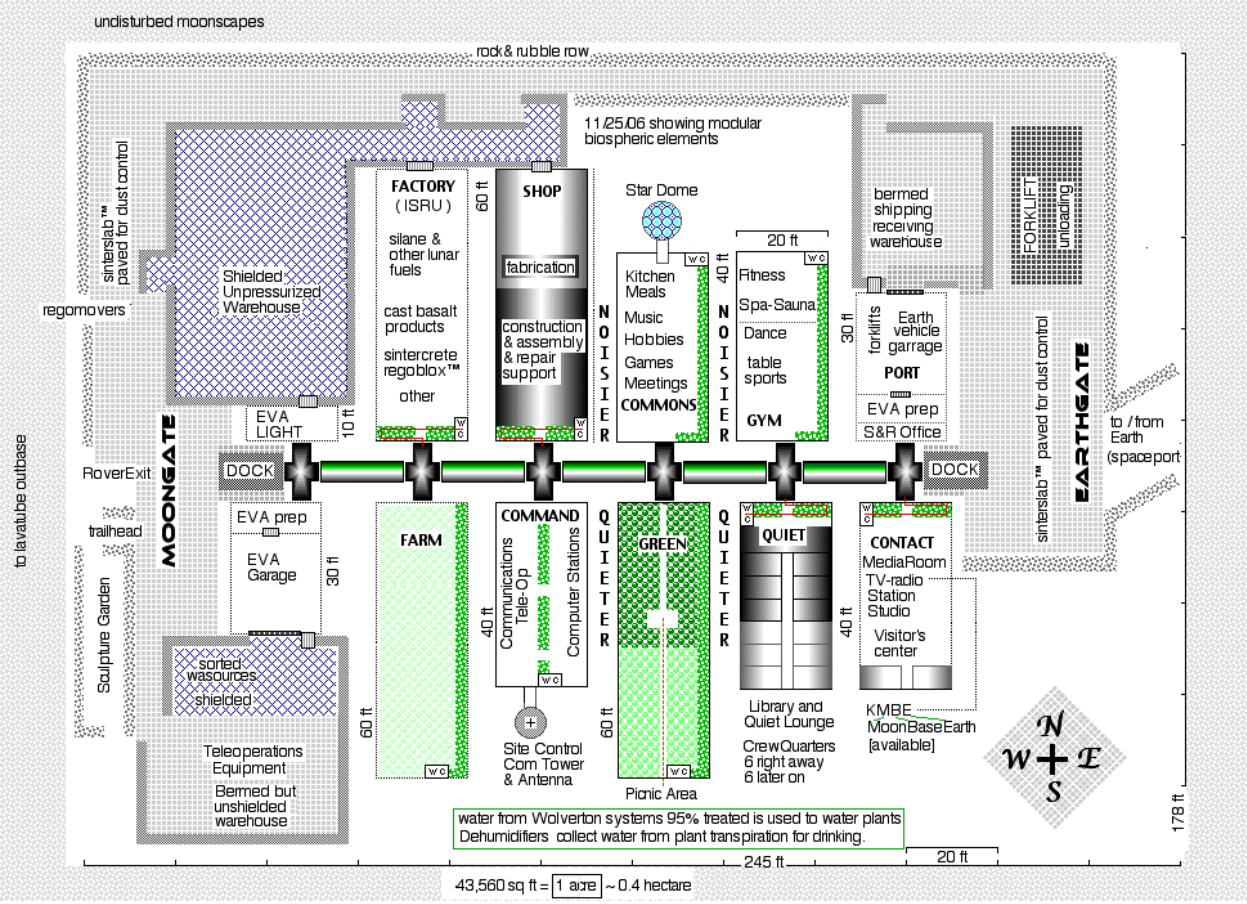
Improvements at the Mars Desert Research Station courtesy of a Moon Society crew in 2005

[I had gotten a place on a crew the year before, 2004, and felt that the Moon Society could learn from having a crew here, and gotten permission to go ahead.]

One of the proposals I made in our Moon Society request to use the Mars Desert Research Station 3 miles west of Hanksville, Utah, was to assemble "pretend" tunnels between the Habitat and the Greenhab (greenhouse) to allow crew members to go from one spot to another without having to wear pretend space suits.

We are happy to see an ***improved and extended*** version of the mockup "tunnels" we had put together out of **pvc pipes** and **netting in 2005**, to make operations more realistic, allowing crew members to go from one facility to another *without donning "spacesuits."*

The **Musk Observatory** (bottom right) has been moved from the hillside (for safety reasons?), and the **Science Dome** (bottom left) is something new, with all the equipment needed to analyze crew "finds."



Inside the Mars Dessert Research Station "**Science Dome**." ##

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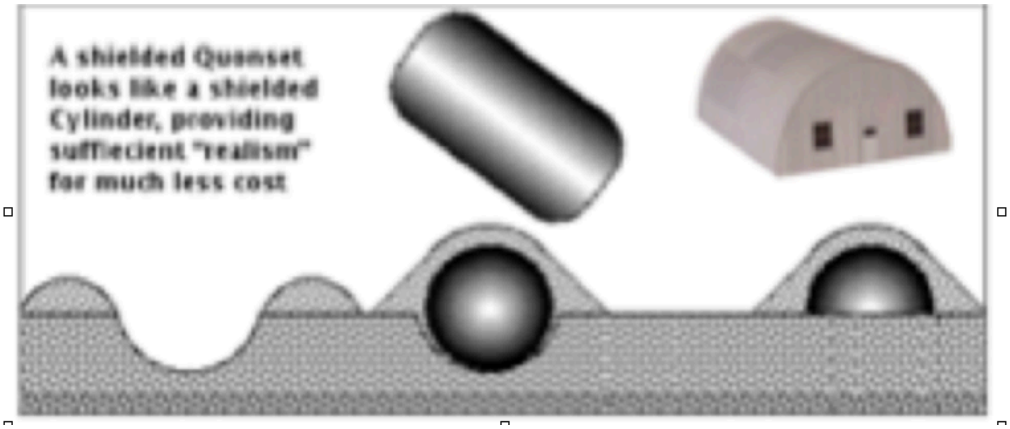
Below: Our Vision of *a more complete* Analog Station, "***if** Money were not an issue"*



In this version, the various linked buildings would be made of pairs of 20 ft wide quonset units, the lower one being upside down to create a 2-floor cylinder. Above/North: ***Commons and Gym****, below/south* ***Green (agriculture)*** *and* ***Quiet Library*** *units would be built first, then the "****factory****" and "****shop****" units.*

Above making a 2 floor cylinder out of a pair of Quonset huts.

Of course, this is a dream and the completed version would cost "mega bucks."

And they would be shielded with a couple of yards/meters of soil, as they would on Moon or Mars as shelter from cosmic rays, and to keep warm in winter, and cool in summer.

The facility could debut with these four units in the "dream plan" above:

But if *we want* ***a starter Mars (or Moon) base designed to grow****, then ……..…*

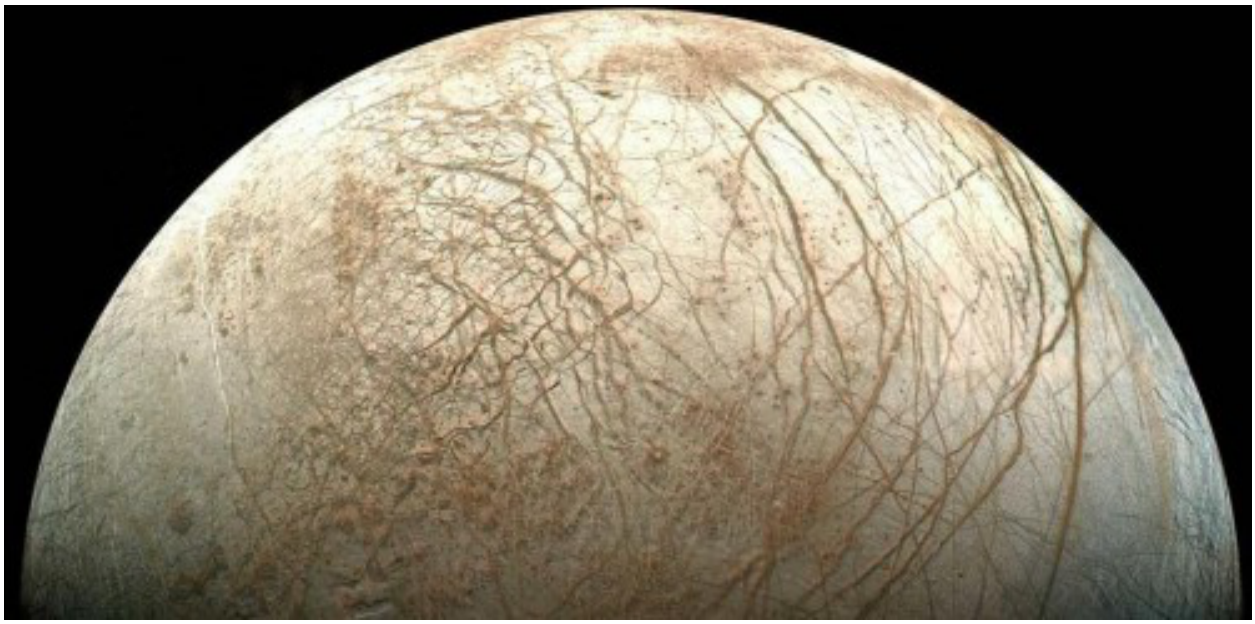
==========

On Earth, earthquakes can take many lives, but still survived by most.

On the Moon or on Mars, "earthquakes" (should we change that to ***"ground quakes" or "crust quakes"****?) could be* ***more catastrophic by breaking the seals of pressurized structures.***

Assuming that both worlds have interiors that are still active, it would be wise to ***a) to determine if proposed settlement sites are on solid ground where there are no signs of previous quakes****, and* ***b) have plans to flee cracked structures and get into those still intact.***

Note: Even if neither the Moon or Mars are geologically active, an impact by a falling asteroidal rock, with enough speed, will cause "marsquakes." That Mars itself is geologically inactive, is quite irrelevant. Settlers should practice their options, regularly enough that "what to do in case" options are known by all. ##



Looking for Life in Europa's global ocean

(NASA has been dilly dallying about this exploration for decades, now.)

1) We need to go beyond orbiting instruments to √ <u>landers on the ice surface</u> to √ <u>analyze the "rust-colored" cracks</u>, √ <u>looking for organic molecules,</u> and √ <u>vestiges of submarine life</u>.

2) Then <u>drilling through the ice</u> and lowering an instrument-packed submarine, to √ <u>map</u> the "undersurface of the ice crust," √ <u>look</u> for "air" bubbles and "air" pockets, √ life clues, √ ocean floor surface features, cracks, heat sources, √ <u>film</u> any creatures, however small, and their motions, and any reaction to our instruments, √ and <u>place instruments</u> on the oceans floor to detect tectonic tumors and quakes.

√ **Yes**, the ice is thicker than we once thought, **but** if we find "organic "bits and pieces" on the surface ice, then ***we really do need to drill through the ice, no matter how thick***, to get ***living samples*** and ***not just of the first creature we come across***.

Finding a plethora of living species under the ice would be **the science find**, not of the year, not of the decade, not of the century, *but* ***of all time!***

3) If there is life in Europa's Global Ocean, <u>*then this kind of life will be prevalent throughout the Universe*</u>. Why? There are far more "***<u>Europids</u>***" than there are "**Terras**," as

Europids can circle any kind of star, even "Brown Dwarfs" and massive gas giant planets such as Jupiter, at whatever distances from their "Suns."

4) That there are so many cracks in Europa's ice shell, would seem to indicate that ***this ice shell is not as thick as many scientists have thought (as an excuse not to drill?)***

To date, NASA has put budget considerations ahead of in depth science.

To date, we have found two "*MUST EXPLORE IN DEPTH* WORLDS'

Jupiters's Europa and Saturn's Titan

These two "worlds" are as "unique and special" as is our Earth.

Finding "exotic life forms on either world" would be the "find of the century,"

Or should we say "of the millennium?" NO! *"The find of all time!"*

What about Saturn's Enceladus? *Its geysers in no way indicate life. ##*

Our Solar System's Most Forbidding Places?
√ Mercury, √ Venus, & Jupiter's closest moon, √ Io

√ **Mercury** is ***not as forbidding as people think:*** √ near its north pole, there is an ice cap, and just below it, what appears to be an entrance to a cool lava tube. √ More, the planet rotates so slowly, that **an Eastbound "Settlement Train" on railroad tracks** could keep up with either dawn or dusk ***at livable temperatures, moving at just 60 mph, no stops! (Stop and get fried!)***

√ **Venus**, the hell hole it is now, ***just might have the two key resources*** to turn it into "a warm" world with **two "high altitude areas (one on each of Venus' two "continents") just cool enough" to support settlements.**

http://lunar-reclamation.moonsociety.org/papers/venus_rehabpaper.htm

√ **Jupiter's "moon-sized" Io *is a very active volcanic nightmare, where, so close to Jupiter, its interior is incessantly tossed by Jupiter's gravity.***

Sorry, Io does not seem to have any "good, but" redeeming features. ##

==========

Currently, we are reminded by two considerable Earhquakes in California, that our planet, Earth, is still geologically alive.

The new "Insight" probe on Mars will tell us how alive Mars' core may still be.

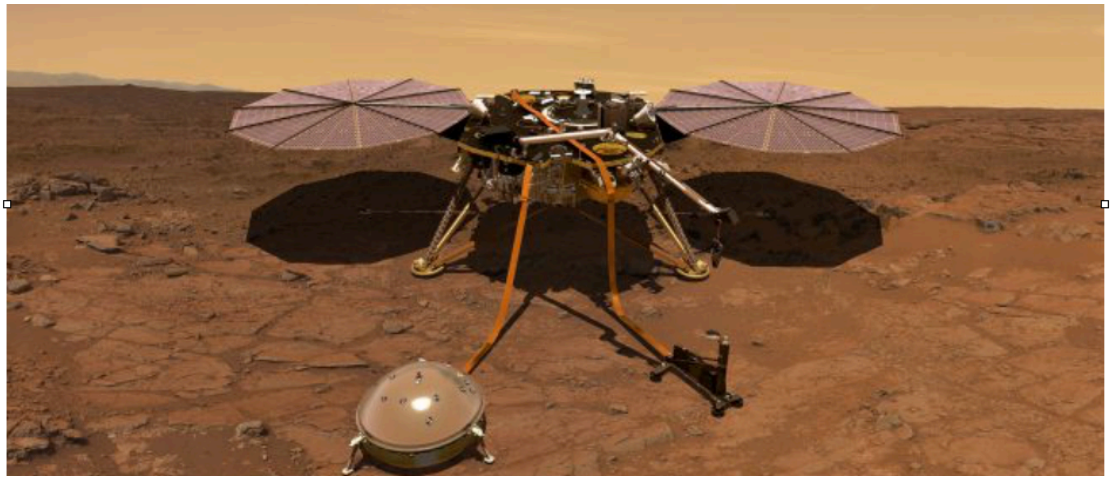
Meanwhile, we are reminded that Earth's molten core is still very much alive and will be so for billions of years to come.

To date, we are still learning how to cope with Earthquakes and have little if any progress in designing home, large buildings, bridges and tunnels etc. to be "shockwave

proof." Nor are we making progress in determining when and where the next quake will be, and how strong it will be.

We are learning how to recover from the considerable damage they bring, but that's it. Earth's core is very much alive, and it just might be that if it were not, we might not be here. Meanwhile we are learning slowly how to recover and get on with life. ##

NASA made history on **Nov. 26, 2018 when its newest Mars probe, the InSight Mars lander**, touched down on the flat plains of Elysium Planitia **to study the Red Planet's core like never before.**



Armed with a crane, heat probe and seismometer, InSight has been probing areas deep below the surface, to listen for Marsquakes and uncover other Martian secrets.

We are all in suspense, waiting for InSight's findings. **If there are "marsquakes," are they often, or rare? Are there any warning signs?** On a world with an atmosphere that is unbreathable, **it is important that the "shells" of our habitats and settlements are designed to survive such events. And just how would we design such features?** (*Actually, we have experience doing so in Earthquake prone areas here on Earth*.)

If there are "Marsquakes," how local are they? Are there areas of Mars that show no signs of ever having experienced a quake, and thus safer to settle?

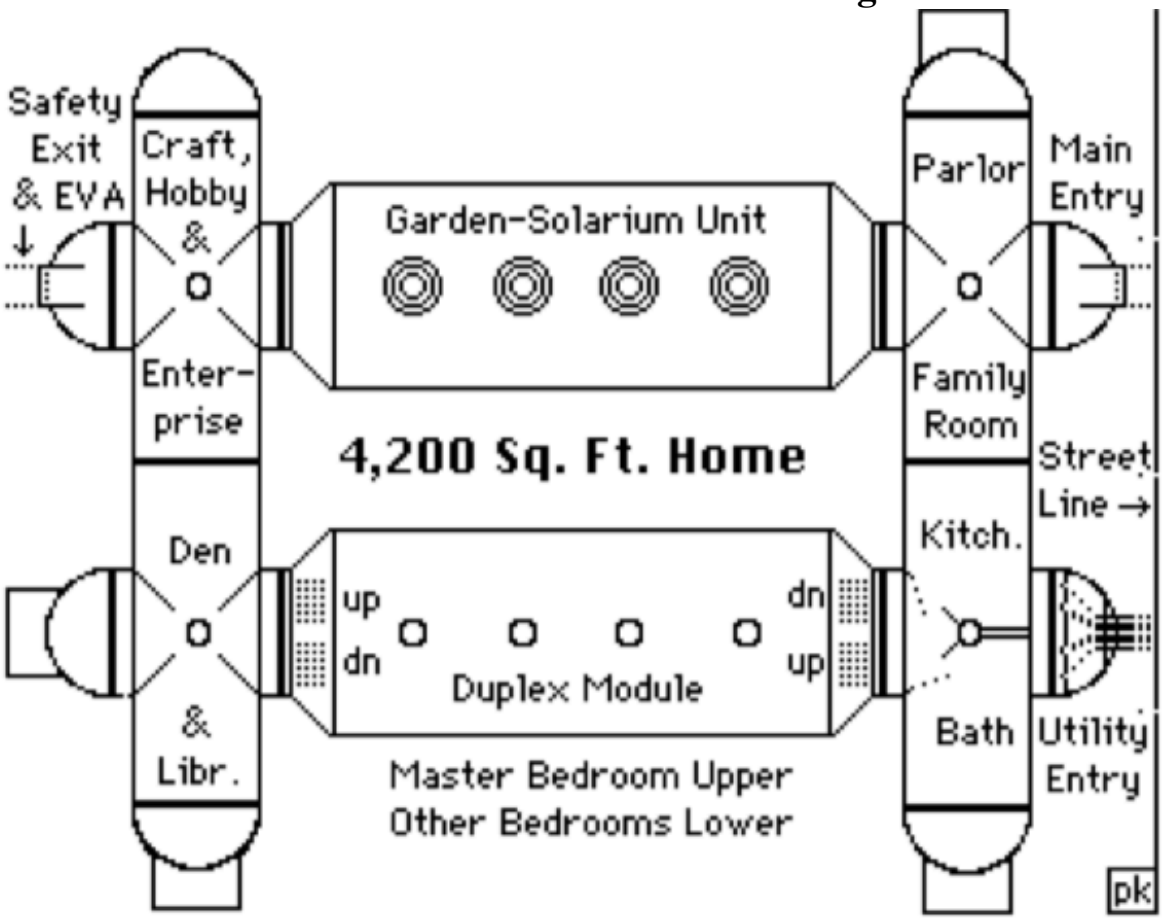
Not only can we ill afford fractures in our breathable air supply, ***neither can we afford breaks in water mains***, as precious as water is on Mars.

Would be Mars settlers await InSight's findings patiently.

Meanwhile, we should try to design all pressurized structures in a way that they won't be compromises by lesser quakes. Of course, the same concerns and measures will apply to settlements on the Moon. ##

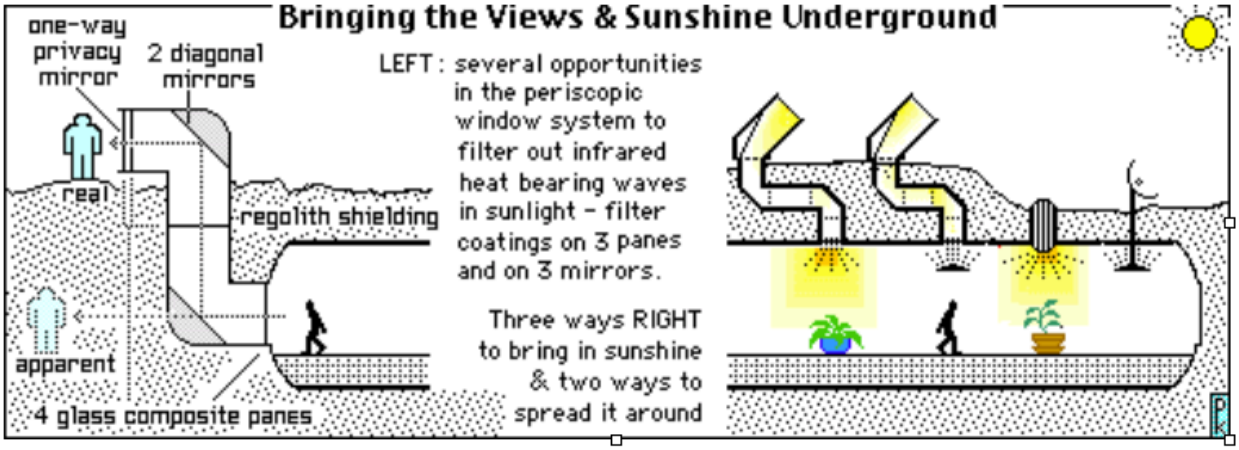
Postscript: One of Insight's probe instruments is stuck partway down
https://spaceflightnow.com/2019/04/03/insight-scientists-not-sure-stalled-mars-heat-probe-can-be-recovered/

What homes on the Moon and Mars might be like



This floor plan is for <u>an expanded home</u>, making room for √ children, more √ at home activities and perhaps for √ home-based starter industries.

I no longer have the software to make any changes in this plan, but **if you take the two left "Safety Exit and EVA hemisphere units and put then up against the "Parlor Family Room" and "Kitchen and Bath, you would have what I think a starter home would look like, with the section labeled "parlor and Family room" being the <u>Bedroom and Den</u>.**

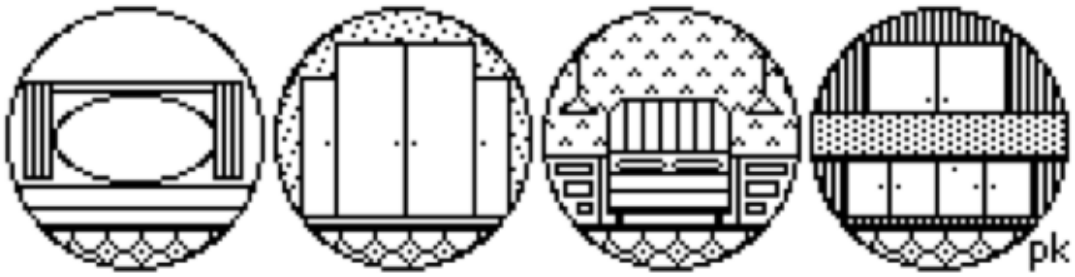


The duplex units would have "Z-vue windows and ceiling "sundows" made of unbreakable Alon, ***as illustrated above.***

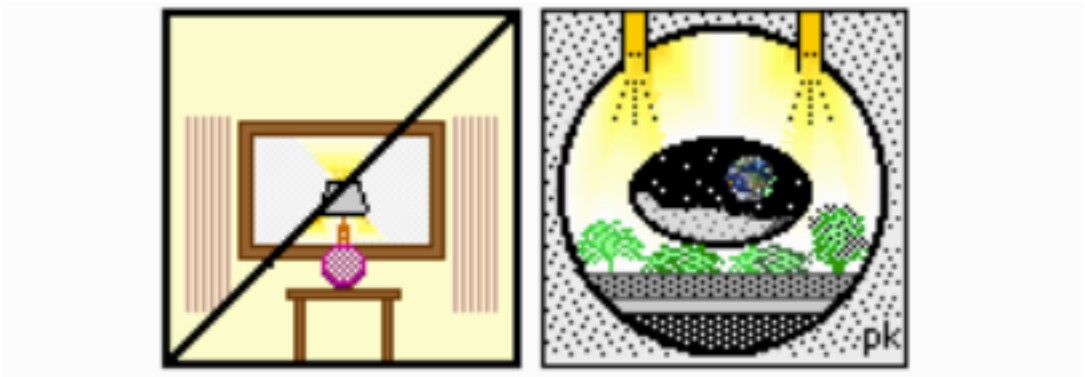
[http://www.surmet.com/technology/alon-optical-ceramics/ **] Note:** Alon "glass" is even bullet-proof! (or fast moving meteorites) Just what's needed on the Moon and Mars!

The starter home might be expanded a) for children, b) or for money making home-based industries. Examples **√ carving items out of basalt, √ sewing fabric odds and ends into patchwork bed covers, √ babysitting for others, √ and many more "cottage industry items.**

The hemisphere "caps" could have any of a number of "built-in" features such as:



The one at left above (and at right below) are unbreakable Alon "Picture Windows" - with a row of **Bonsai miniature trees** on a shelf below the window. Such a feature might be a popular way to bring "a bit of old Earth" inside. [**Google "Bonsai Trees"** for many more photos of these mini trees, and how to "grow" one ***yourself*** from a sprout of a normal size tree.



Above: Picture windows on Earth *left*, and on Moon or Mars *right*

(the window in the Moon (or Mars) version is the inner Oval with a view of Earth)

Additions to the "**Starter Home**" would be put in place and connected by **one of the cranes** "outside, as would covering the original home, and home additions added later with a couple of yards/meters of Mars dust.

There would be **ample room <u>between</u> residential passenges** & attached homes and **commercial ones** (with attached **container industries and outlet shops**) for cranes to operate and move around the Mars top "rock soil" as needed. ##

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