

The Outer Solar System: What we've learned in the past three decades*

How big is the solar system? www.space.com/30610-scale-of-solar-system-amazing-video.html "If Earth were as small as a marble, the solar solar out to Neptune would cover an area the size of San Francisco"

Feature Articles

- 2 In Focus: The need to develop faster rockets, much much faster! Peter Kokh
- 3. Jupiter and its moons: what we have learned and still need to learn Peter Kokh
- 4. Saturn and Titan: what we have learned and still need to learn Peter Kokh
- 5. Uranus and Neptune and their moons What we have learned and still need to learn Peter Kokh
- 6. "Astronomy" and "Space Apps" for Smart Phones & Tablets Peter Kokh
- 7. Making it on Mars Dave Dietzler
- 8. Journey to Another World: A Cascade Space Walk poem by Robert McGowen

About Moon Miners' Manifesto - "The Moon - it's not Earth, but it's <u>Earth's!</u>"

- MMM's VISION: "expanding the human economy through off-planet resources"; early heavy reliance on Lunar materials; early use of Mars system and asteroid resources; and permanent settlements supporting this economy.
- MMM's MISSION: to encourage "spin-up" entrepreneurial development of the novel technologies needed and promote the economic-environmental rationale of space and lunar settlement.
- Moon Miners' Manifesto CLASSICS: The non-time-sensitive articles and editorials of MMM's first twenty years plus have been re-edited, reillustrated, and republished in 23 PDF format volumes, for free downloading from this location: http://www.MoonSociety.org/publications/mmm_classics/
- MMM THEME Issues: 14 collections of articles according to themes:/publications/mmm_themes/
- MMM Glossary: new terms, old terms/new meanings: www.moonsociety.org/publications/m3glossary.html
- MMM retains its editorial independence and serves many groups, each with its own philosophy, agenda, and programs. Sharing MMM may suggest overall satisfaction with themes and treatment, requires no other litmus test.

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- MMM color online downloadable PDF file version option for Moon Society Members using their username and password do write secretary@moonsociety.org if you need help with your password.
- For additional space news and near-term developments, there is a daily RSS feed space news section on http://www.moonsociety.org. You can also read Ad Astra magazine mailed to National Space Society members. •

Milwaukee Lunar Reclamation Society is an independently incorporated nonprofit membership organization engaged in public outreach, freely associated with the National Space Society, insofar as LRS goals include those in NSS vision statement. MLRS serves as the Milwaukee chapter of both The National Space Society and The Moon Society: - http://www.moonsociety.org/chapters/milwaukee/

• The National Space Society is a grassroots pro-space member-ship organization, with 10,000 members and 50 chapters, dedicated to the creation of a spacefaring civilization.

National Space Society 1155 15th Street NW, Suite 500 Washington, DC 20005 (202) 429–1600 - www.NSS.org

- The Moon Society seeks to overcome the business, financial, and technological challenges to the establishment of a permanent, self-sustaining human presence on the Moon." Contact info p. 9.
- NSS chapters and Other Societies with a compatible focus are welcome to join the MMM family. For special chapter/group rates, write the Editor, or call (414)–342–0705.
- Publication Deadline: Final draft is prepared ASAP after the 20th of each month. Articles needing to be keyed in or edited are due on the 15th, Sooner is better! No compensation is paid.
- Submissions by email to KokhMMM@aol.com Email message body text or MS Word, Open Office Text files, and pdf file attachments or mailed CDs, DVDs, or typed hard copy [short pieces only, less than 1,000 words] to:

 Moon Miners' Manifesto, c/o Peter Kokh, 1630 N. 32nd Street, Milwaukee, WI 53208-2040

In Focus The need to develop faster rockets, much much faster!

By Peter Kokh

For Space Exploration, it's time to morph "from Caterpillar to Butterfly"

We have all accepted the long duration of unmanned probes to the outer solar system planets and beyond. To the patient, what is a "few years?" But if someday we should want to send humans beyond Mars, to Jupiter's Europa or perhaps to Saturn's Titan, trip times of several years are not inviting.

NASA is "finally" showing interest in maturing **Vasimir technology** pioneered by astronaut Franklin Chang-Diaz [https://en.wikipedia.org/wiki/Variable_Specific_Impulse_Magnetoplasma_Rocket] as a way to get to Mars faster, so that the crews do not arrive too weak to "hit the ground running" and without too much exposure to cosmic rays. This works for Mars. For Jupiter's Moons? That's stretching it, but right now "all we've got." **Also:**www.nasa.gov/press-release/nasa-to-discuss-latest-developments-in-solar-electric-propulsion-for-future-deep-space and

 $\underline{www.nasa.gov/press-release/\textbf{nasa-works-to-improve-solar-electric-propulsion-for-deep-space-exploration}$

What are the options? Accepting the long trip times and handling them by putting crews to sleep for the duration? That is the popular choice in many novels and films. But the risks of long journeys is not a matter of caterpiller thumbs, but or radiation exposure, and more importantly, of loss of public support.

We need ships that can accelerate constantly to the half way point, then deccelerate for the rest of the trip, and that needs an impractical amount of fuel. If we want to send crews to Jupiter's Europa and Saturn's Titan, we had best start brainstorming new approaches to the transportation problem. ##

For past articles, Visit http://www.moonsociety.org/publications/mmm_classics/ or /mmm_themes/

Jupiter and its moons: what we have learned and still need to learn

By Peter Kokh

Basic Information: https://en.wikipedia.org/wiki/lupiter

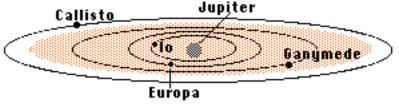
JUNO Mission underway - www.nasa.gov/mission_pages/juno/overview/index.html

What we don't know and need to know about Jupiter

Our knowledge about Jupiter is superficial; we need to brainstorm missions that descend through the cloud decks. One that penetrated through the big orange huricane-like "spot" should be at the top of the list.

Jupiter's four large moons







Only Callisto orbits outside Jupiter's Radiation Belt

Luna, the original "The Moon" of Earth is larger than Europa, smaller than lo

Europa Mission proposals

http://www.nasa.gov/press-release/all-systems-go-for-nasas-mission-to-jupiter-moon-europa\http://www.jpl.nasa.gov/missions/europa-mission/

https://en.wikipedia.org/wiki/Europa Multiple-Flyby Mission

Why Europa should be at the top of the Research List

"Europids" – worlds whose ice crust caps a global ocean of some depth kept liquid by the gravitational forces of its primary which can be a gas giant planet like Jupiter or Saturn, or a planet around a Brown Dwarf (a stand alone object too large to be called a planet and too small to ignite internal fusion and become a star. They have masses that range between twice the mass of Jupiter and the lower mass limit for nuclear reactions (0.08 times the mass of our sun).) Brown Dwarfs are likely to have planets. Brown Dwarfs must be very numerous throughout the galaxy and in other galaxies. If life can arise in Europids, then such life systems must vastly outnumber Earth-like planets and Earth-like ecosystems by many orders of magnitude.

What we don't know and need to know about Europa

- How thick is Europa's crust? How much does the thickness vary?
- What chemicals give the many cracks in Europa's ice crust their orange color? Inert materials? Organic
 materials from living organisms that oozed to the surface every time a new crack occured? A lander on one of
 these cracks capable of anylizing chemicals be they inorganic or organic should be Mission 1 and it does
 not seem to be on NASA's list or on the list of those submitting Europa mission proposals. For shame!
- Manned Europa Outposts? If unmanned landers find relics of life in that moon's orange cracks, a manned outpost on Europa (easily shielded by ice) might be in order.

Missions to other moons of Jupiter

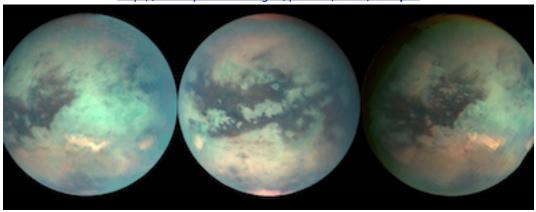
- Callisto is the outermost of Jupiter's four large moons, only slightly smaller than Ganymede, and most importantly, beyond the range of Jupiter's radiation belt. This makes Callisto the logical host for a manned outpost in the Jovian system, one that can outfit manned missions to Europa and jacket inbound manned craft in ice for radiation protection. Initial missions to Europa need not be manned.
- Manned Missions and Outposts will require much faster transportation than chemical rockets provide Reading: http://www.moonsociety.org/publications/mmm_papers/europa_outpost_paper.htm

Saturn and Titan: what we have learned and still need to learn

By Peter Kokh

Basic Information: https://en.wikipedia.org/wiki/Saturn

https://en.wikipedia.org/wiki/**Titan_(moon)** - http://solarsystem.nasa.gov/planets/**titan** http://solarsystem.nasa.gov/planets/**titan/indepth**



Titan (Mission proposals) below



Three views of Titan below the clouds (above)



- https://en.wikipedia.org/wiki/Titan_Saturn_System_Mission
 https://upload.wikimedia.org/wikipedia/commons/thumb/1/11/TSSM-TandEM-Orbiter.jpg/800px-TSSM
 -TandEM-Orbiter.jpg
- https://en.wikipedia.org/wiki/Titan_Mare_Explorer
 https://upload.wikimedia.org/wikipedia/commons/thumb/7/70/TSSM-TandEM-Lander.jpg/260px-TSSM-TandEM-Lander.jpg
- http://www.space.com/28589-titan-submarine-robotic-saturn-ship.html http://www.space.com/images/i/000/045/720/original/titan-submarine-sea-kraken-mare.jpg

Our Take

Titan is the most exotic "world" (Beyond Earth) in the Solar System. Exploring Titan, and possibly "life as we do not know it" should have top scientific priority.

If NASA/U.s. Congress can't/won't pursue it (beyond the highly productive Cassini-Huyghens mission) then hopefuly the European Space Agency and other national space agencies will. We have to cast off the shackles of pre-approval by the U.S. Congress which does not understand or care about these things.

We need to find other sources of funding: major corporations might be interested.

That it takes so long for conventional rockets to get to Saturn, is all the more reason to give Titan exploration top priority, on a par with outposts on the Moon and Mars and exploration of Europa,

Saturn's Moon lapetus - https://en.wikipedia.org/wiki/lapetus (moon)

Half the diameter of the Moon, **lapetus circles Saturn in an orbit inclined** 15.47° to Saturn's equator, alternately above and below the plane of Saturn's rings, providing the best closeup views. While it may be decades before tourists can visit lapetus, we could put a camera system on this Moon aimed at Saturn, with the feed constantly beamed Earthwards so that people on Earth could share this spectacle live. (Keep in mind that lapetus keeps the same side turned towards its host planet, as is common with most moons, including our own.) **Enceladus** – We are not convinced that further exploration of this moon's south polar water-ice jets are worth manned exploration. ##

Uranus and its moons: what we have learned and still need to learn

By Peter Kokh

Basic Information: https://en.wikipedia.org/wiki/Uranus https://en.wikipedia.org/wiki/Moons of Uranus



Uranus has 27 known moons, divided into three groups: 13 inner moons, 5 major moons, and 9 irregular moons. The inner moons are small dark bodies that share common properties and origins with the Uranus' rings.

The five major moons (depicted above) have reached hydrostatic equilibriumm. Four of them show signs of internally driven processes such as canyon formation and volcanism on their surfaces. [2] The largest of these five, Titania, is 1,578 km in diameter and the 8th largest moon in the Solar System, and about 1/20th the mass of the Moon. The orbits of the regular moons are nearlycoplanar with Uranus's equator, which is tilted 97.77° to its orbit. Long term, Titania might supportr harvesting Uranus' atmosphere's lode of Helium-3, a fusuion fuel. ##

Neptune and its moons: what we have learned and still need to learn

By Peter Kokh

Basic Information: https://en.wikipedia.org/wiki/Neptune

https://en.wikipedia.org/wiki/Moons_of_Neptune

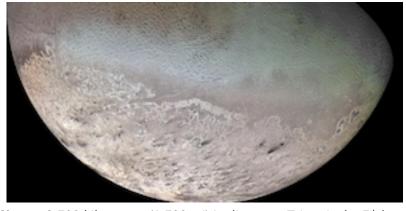
https://en.wikipedia.org/wiki/Triton_(moon)

http://astro.if.ufrgs.br/solar/triton.htm

http://www.nature.com/nature/journal/v441/n7090/full/nature04792.html

https://www.youtube.com/watch?v=HysMekBpzk4 (live Triton encounter by Voyager 2, August 25, 1989 (Watching it live on NASA TV was one of the top highlights and thrills of this writer's life)

Triton's landscapes as watched by many of us live





Size: at 2,700 kilometres (1,700 mi) in diameter, Triton is the 7th largest moon in the Solar System and one of the few moons in the Solar System known to be geologically active.

Triton is unique among moons of planetary mass in that its orbit is retrograde to Neptune's rotation and inclined relative to Neptune's equator, which suggests that it did not form in orbit around Neptune but was instead gravitationally captured by it. It is most likely a captured "Kuiper Belt" object

Mission Proposals (none of which has been pursued or is on NASA's agenda):

https://en.wikipedia.org/wiki/Neptune_Orbiter

http://spaceflightnow.com/2015/08/25/uranus-neptune-in-nasas-sights-for-new-robotic-mission/

http://www.spacetoday.org/SolSys/Neptune/NeptuneProbe.html

http://www.planetary.org/blogs/emily-lakdawalla/2008/1729.html

http://xxx.lanl.gov/abs/1106.0132

No manned mission has been proposed to our knowledge. A Triton orbiter mission is in order ##

For past articles, Visit http://www.moonsociety.org/publications/mmm classics/ or /mmm themes/

"Astronomy" and "Space Apps" for Smart Phones & Tablets

Courtesy of the Editor

What is available??? Google finds the following

International Space Apps Challenge

https://en.wikipedia.org/wiki/International Space Apps Challenge

"The International Space Apps Challenge is an international mass collaboration focused on space exploration that takes place over 48-hours in cities around the world. The event embraces collaborative problem solving with a goal of producing relevant open-source solutions to address global needs applicable to both life on Earth and life in space...NASA is leading this global collaboration along with a number of government collaborators and over 100 local organizing teams across the globe." [1]

Space Apps is annual NASA's global <u>hackathon</u>, first held in April 2012,^[2] and serves as innovation incubation program. NASA and its partners put out challenges relating to current work for which space enthusiasts around the world of all backgrounds can develop innovative solutions (which can be more than just apps!), particularly focusing on use of NASA data and promoting education.

Technology drives Exploration https://2016.spaceappschallenge.org/challenges/tech

- Jetset Mars: https://2016.spaceappschallenge.org/challenges/tech/jet-set-mars
- Print my Rocket: https://2016.spaceappschallenge.org/challenges/tech/print-my-rocket
- Backfill my model: https://2016.spaceappschallenge.org/challenges/tech/backfill-my-model

Aeronautics: NASA is with you when you fly

- Don't Crash my Drone: https://2016.spaceappschallenge.org/challenges/aero/dont-crash-my-drone
- Clouds or Contrails?: https://2016.spaceappschallenge.org/challenges/aero/clouds-or-contrails
- Clear for Takeoff: https://2016.spaceappschallenge.org/challenges/aero/clear-for-take-off

Space Station https://2016.spaceappschallenge.org/challenges/space-station

• Launch: a Global Experience:

https://2016.spaceappschallenge.org/challenges/space-station/launch-a-global-experience

Rock-it Space Fashion & Design:

https://2016.spaceappschallenge.org/challenges/space-station/rock-it-space-fashion-and-design

• Astrosize: https://2016.spaceappschallenge.org/challenges/space-station/astrocize

Ten Best Space Apps | Android, iPhone, iPad - Laptop Mag

http://www.laptopmag.com/articles/best-space-apps#sthash.DG2osHtm.dpuf

The NASA App (Free, Android, iOS) serves as a gateway to the latest news from the world's premier space agency. The app provides access to a huge amount of information about NASA, its many missions and the cosmos, delivered via feature stories, photos, videos, live webcasts and more.

- Space Images (free; iOS and Android)
- Exoplanet (free: iOS)
- Planets (free; iOS and Android)
- Sky Safari 3 (\$2.99; iOS and Android)
- Satellite Flybys (\$2.99; iOS and Android)
- NASA Space Weather Media Viewer (free: iOS and Android)
- Mars Globe (free, version with HD 99 cents; iOS)
- Moon Phase Pro (99 cents; Android)
- Galaxy Collider (99 cents; iOS)

MORE: SpaceApps is a NASA incubator innovation program.

https://open.nasa.gov/explore/space-apps/ -

Global citizens work with open data and APIs to solve challenges within categories designed to support NASA's ongoing missions. As a result, participants produce hundreds of projects making open source solutions with immediate value to NASA and the global community.https://2016.spaceappschallenge.org

Exploring the Moon by Hand with Mobile Astronomy Apps

www.space.com/32667-explore-the-moon-mobile-astronomy.html

Mars on the Go! NASA Be A Martian Mobile App - http://mars.nasa.gov/mobile/info/

Moon Society / National Space Society input on Space Apps creation and promotion

Help brainstorm Apps that "explore" the Moon and Mars and options for "permanent human settlement" on both worlds. APPS are important! They appeal to persons who want to do more than just "read" the latest news, but who want to help explore and settle these worlds. We need Apps to explore Europa's Ocean and Titan's Lakes as well as to "design" settlements on all these worlds as well as in free space!

Most importantly, Apps are "The Key" to involving young people!

For past articles, Visit http://www.moonsociety.org/publications/mmm_classics/ or /mmm_themes/

Making it on Mars

By Dave Dietzler

I was reading an article about a return to DC power since solar panels make DC and many devices have power convertors that turn AC into DC.

See: http://www.resilience.org/stories/2016-05-03/slow-electricity-the-return-of-dc-power
The article went on to describe a low power lifestyle...

"Obviously, this strategy implies a change in our way of life. It would mean that electricity is used only for lighting, electronics and refrigeration, while non-electric alternatives are chosen for all other appliances. Not coincidentally, this is quite similar to how DC grids were operated in the late nineteenth century, when the only electric load was for lighting -- first arc lamps and later incandescent bulbs.

"Thus, no dishwasher, but doing the dishes by hand. No washing machine, but doing the laundry in a laundromat or with a manually operated machine. No tumble dryer, but a clothes line. No convenient and time-saving kitchen appliances like electric kettles, microwaves and coffee machines, but a traditional cooking stove operated by (bio)gas, a solar cooker, or a rocket stove. No vacuum cleaner, but a broom and a carpet-beater. No freezer, but fresh ingredients. No electric warm water boiler, but a solar boiler and a small wash at the sink if the sun doesn't shine. No electric car, but a bicycle."

It struck me that early Mars colonists might adopt such a low tech low energy lifestyle during initial colonization instead of hauling heavy appliances to Mars like clothes washing machines and electric dryers, dish washing machines, etc. Plastic dinnerware would be washed by hand in plastic basins and clothes would be washed by hand in plastic tubs unless they imported a plastic laundry machine operated by bike and hung the clothes to dry on a line. There would be no frozen food but simply dehydrated food in vacuum packs and canned goods to eat until the hydroponic farms were producing fresh food. It might be possible to use the outdoors cold of Mars to store leftovers instead of importing heavy refrigerators. Cooking could be done with electric hot plates and solar cookers instead of heavy stoves and ovens.

It will be possible to produce plastics on Mars with carbon from the atmosphere and hydrogen from water in the regolith. Dr. Robert Zubrin has written plenty about that in "The Case for Mars." A small mining machine like a Bobcat and compressors to pump down atmosphere and some processing equipment will be needed along with solar panels for power. Almost anything can be made of plastic by using injection molding machines and 3D printers.

It will be easy to mine for hydrogen and carbon on Mars and it will be easy make things with plastics. As time goes by the need for more than plastic will arise. Metals will be needed for electric motors, vehicles, mining machinies, more 3D printers, etc. The best way to get metals out of complex regolith mixtures might be a device that resembles a mass spectrometer like the Supersonic Dust Roaster and All Isotope Separator designed by Dr. Peter Schubert. See:

http://nsschapters.org/hub/pdf/MoonRockstoSaveEarth.pdf and

http://www.freepatentsonline.com/y2005/0199797.html and

http://www.freepatentsonline.com/6614018.html and

http://enu.kz/repository/2010/AIAA-2010-8703.pdf

Dr. Schubert's work has been aimed mostly at the Moon but the same process could be used to get oxygen from martian regolith along with silicon and other elements for solar panels and metals like iron and aluminum for construction. Schubert's and Zubrin's work are must reads for all would be space colonists.

Expansion of the first colony on Mars will demand more power and more solar panels. Various devices like rolling mills and 3D printers will be needed to make all sorts of parts to make more machines including more manufacturing devices like mills and 3D printers and more production devices like compressors, Sabatier reactors and element separators.

The Mars colony will use local resources to expand or "bootstrap." Eventually large solar panel farms will produce plenty of power and it will also be possible to build washing machines, dryers, refrigerators and all the other conveniences of modern life on Mars.

At first colonists will live in inflatable modules. Later they will make mud bricks, stack them in dug trenches to build habitations, and cover them with a heavy layer of regolith to counter the pressure inside and provide thermal and radiation protection. It will become possible to make clothing and spacesuits from synthetic materials. Hemp, cotton and flax might also be cultivated.

Plastic domes 50 to 100 meters in diameter might be made for farming on Mars. Iron molds could be made with 3D printers to cast all sorts of things made from vitrified regolith melted in a solar furnace. It should also be possible to produce glass on Mars by extracting silicon dioxide from regolith. There might be deposits of ores on Mars formed by hydrothermal processes. It could be worthwhile to drive long distances or dispatch robots to reach these ore deposits. Robot miners could be teleoperated from the main Mars base via small communications satellites in "areosynchronus equatorial orbit."

There's no place like Mars! - DDz

Editor: This article illustrates how different will be the constraints on settlers of Mars from those that will apply to settlers on the Moon, where the elements out of which plastics are made are present in only "micro" portions.

However, anything made of plastic brought to the Moon, could be reshaped and recast into useful things. In MMM # 26, I wrote the article "Toy Chest; ThermoPlastics" reprinted in this Theme issue: http://www.moonsociety.org/publications/mmm_themes/mmmt_EdenOnLuna.pdf

I noted that thermoplastics, ideal for toys, can be reformed over and over again. I also pointed out that thermoplastics might be imported from Mars, at less expense than from Earth. PK

Journey to Another World: A Cascade Space Walk

By Robert McGown RAS,*

From Enchantment lakes to ice caves with ancient ice Canyons and metamorphic pinnacles paint the landscape Sleeping volcanoes wind along the chain of mountains Some with frozen lakes on their summit

Bubbling hot geyser pools with Pleistocene erratics Glaciers wind down the face between ridges Ice as a reminder of frozen epochs gone by Bergschrunds and seracs of ice, amaze the mountain space walker

Walking a mountain ridge, we exist in another world A surreal existence between mountains and space Are we on Earth or really on Mars? As we ascend a Cascade shield volcano

Extreme life takes a foot hold here Hiding underground or in nooks and crannies In one little oasis, dozens of species dwell Sharing the mountain with insects and marmots

On this space like terrain, humans are just visitors Astronaut kids from the city, visit mountain space We ascend into the thin atmosphere As a climber on the way to the stars ##

*author of Space/ Mountaineering Analogues

*Member, Oregon L5 Society, NSS chapter

THE MOON SOCIETY - LUNAR FRONTIER SETTLEMENT - WWW.MOONSOCIETY.ORG

From Africa to the Moon. the Human Epic, told in footprints, Continues to the Stars!







Our Goal is Communities on the Moon involving large scale industrialization and private enterprise.

The Moon Society Journal Section (pages 9-12)

About the Moon Society

Objectives of the Moon Society include, but are not limited to:

- Creation of a spacefaring civilization, which will establish communities on the Moon involving large-scale industrialization and private enterprise.
- Promotion of interest in the exploration, research, development, and habitation of the Moon, through the media of conferences, the press, library and museum exhibits, and other literary and educational means
- Support by funding or otherwise, of scholarships, libraries, museums and other means of encouraging the study of the Moon and related technologies
- Stimulation of the advancement and development of applications of space and related technologies and encouragement their entrepreneurial development
- Bringing together persons from government, industry, educational institutions, the press, and other walks of life for the exchange of information about the Moon
- Promoting collaboration between various societies and groups interested in developing and utilizing the Moon.
- Informing the public on matters related to the Moon
- Provision of suitable recognition and honor to individuals and organizations that have contributed to the advancement of the exploration, research, development, and habitation of the Moon, as well as scientific and technological developments related thereto.

Our Vision says it all - "Who We Are and What We Do" - www.moonsociety.org/spreadtheword/whowhat.html We envision a future in which the free enterprise human economy has expanded to include settlements on the Moon and elsewhere, contributing products and services that will foster a better life for all humanity on Earth and beyond, inspiring our youth, and fostering hope in an open-ended positive future for humankind.

Moon Society Mission: to inspire and involve people everywhere, from all walks of life, to create an expanded Earth-Moon economy that contributes solutions to the major problems that challenge our home world. Moon Society Strategy: We seek to address these goals through education, outreach to young people and to

people in general, competitions & contests, workshops, ground level research and technology experiments, private entrepreneurial ventures, moonbase simulation exercises, tourist centers, and other means.

Interested in having input? Any member may ask to join the Leadership Committee and attend our Management Committee meetings held twice monthly. You may even express opinions. Decisions are often made by consensus, so this input has value. Write president@moonsociety.org

From Moon Society President Ken Murphy



Some notable developments over the last month:

- Orbital ATK announces they want someone to pay them to develop a cislunar habitat. Some notable weaknesses are design for launch on SLS, and emplacement in Low Luanr Orbit (LLO) instead of at EML-1, where it would be much more useful.
 - https://www.nasaspaceflight.com/2016/05/orbital-atk-cislunar-habitat-missions-sls-orion/
- · Planetary Resources decides to use the sensors they've developed to launch yet more Earth-observation satellites via their subsidiary Ceres, which just received \$21.1Mn in funding. Sounds to me like mission creep, which is the sort of thing that caused troubles at XCOR. http://www.parabolicarc.com/2016/05/26/planetary-resources-announces-21-million-funding-round-sat-con stellation/
- XCOR laid off a number of employees working on the Lynx suborbital vehicle. Moreso than Virgin Galactic, XCOR was focused on the microgravity science aspect of that market. If you accept the idea that suborbital flights provide a proving ground to expose the merits of certain areas of research to be undertaken in labs in cislunar space, then this is a setback.

http://www.parabolicarc.com/2016/05/28/xcor-layoffs-update/

The Moon Society - Lunar Frontier Settlement - www.moonsociety.org p.2

• Bigelow's BEAM module was inflated at the space station. While this is progress, the BEAM joins the Genesis I and II modules that have been in orbit for years. What's needed are more free-flying Bigelow facilities being leased into the market, but realistically we have to wait for development (again) in the U.S. of crew-to-orbit capability for workers to get to and from the facilities.

Government leadership on space issues continues to be incoherent, and NASA continues to be distracted by the foci of #Journey2Mars and Earth observation activities. Space is largely a non-issue in the mess of a presidential campaign we have going on, reflecting a seeming broader consensus that space activities have a de minimus effect on either the economy or our society. Both are untrue, and part of job here at The Moon Society is disabusing folks of this notion, and pointing out that investment in cislunar infrastructure development can have an enormous positive impact on both our economy and our society. There's no question that cislunar space is where the action will be over the next couple of decades.

From a societal perspective, I remember something that Arthur C. Clarke noted in his book "The Exploration of the Moon", where he points out that frontiers are where we send our disaffected, our malcontents, our outsiders, and that this is a good thing as it helps to keep the peace for the folks that have no interest outside their own little worlds of work and home. When the troublemakers have nowhere to go and nothing to do, they will be making trouble somewhere. Might as well be someplace where they can do us some good. But that's not a dialogue that our society has any interest in having, and frankly it's more profitable to imprison the malcontents and try to keep them out of society in that fashion.

There's a sea change coming, if for no other reason than the status quo ante has become rotten to the core, and can barely stand, coupled with a huge new generation moving into society, bringing their priorities with them. Let's hope that space development is one of those priorities. – KM

Student Experiments Vital for Space Research

www.space.com/30936-student-experiments-space-research-pat-hynes.html

The International Symposium on Private and Commercial Spaceflight is an annual meeting for industry's top leaders and innovators, Its central purpose is to get student projects off the ground. ##

Beautifully detailed 3D printed Moon brings lunar light into your home

 $\underline{www.3ders.org/articles/20160413-\textbf{beautifully-detailed-3d-printed-moon-brings-lunar-light-into-your-home.} \\ \underline{-your-home.} \\ \underline{true}$





14 April, 2016 - Thanks to a brilliant combination of NASA Lunar data, 3D printing technology, and exquisite engineering, a team of designers has created MOON, the first topographically accurate lunar globe that displays actual lunar phases in real-time.

Don't miss these coming must-see skywatching events

www.space.com/31550-12-best-skywatching-events-of-2016.html

July 29: An occultation of Aldebaran. This one occurs in the dawn twilight and involves a waning gibbous moon. The occultation will be visible over western Canada and the United States, low in the east-northeast sky before Sunrise.

The Moon Society – Lunar Frontier Settlement – <u>www.moonsociety.org</u> p. 3

Aug. 11-12: The Perseid meteor shower. The Perseids are mong the best of the annual meteor showers, thanks to their reliability and high rates of up to 90 "shooting stars" per hour. This year's peak will occur well after the moon — which will be just past first quarter — sets around midnight. There is also a possibility of a meteor outburst, which might produce an enhanced display this year.]

Aug. 28: A brilliant double planet. Shortly after Sunset, in the west-southwest sky, the two brightest planets, **Venus** and **Jupiter**, will be strikingly close together. As seen from the Atlantic Seaboard, for example, only 5 arc minutes (or one-sixth the apparent width of the moon in our sky) will separate the two, making for a very eye-catching sight!

Train Like a Martian Challenge Inspires Kids to Get Active

www.space.com/32087-train-like-a-martian-kids-challenge.html



The **Train Like a Martian** program challenges kids to participate in daily physical activities, just like a NASA astronaut would

The nonprofit group The Mars Generation (TMG) is inviting children (and adults, too) to "Train like a Martian" between April 18 and April 24. The initiative is inspired by NASA's "Train Like an Astronaut" program, which encourages physical activity among children by comparing it with astronaut training. (TMG has no affiliation with NASA.) ##

Crowdsourcing the Universe: Citizen Scientists Driving Discovery

www.space.com/31626-crowdsourced-astronomy-finding-faint-galaxies-in-deep-space.html

Astronomers are increasingly enlisting volunteer "citizen scientists" to help them examine a seemingly endless stream of images and measurements of the universe, and their combined efforts are having a powerful impact on the study of the cosmos.

Last November, a citizen science project called **Space Warps** announced the discovery of 29 new gravitational lenses, regions in the universe where massive objects bend the paths of photons (from galaxies and other light sources) as they travel toward Earth.

As cosmic phenomena go, the lenses are highly prized by scientists because they offer tantalizing glimpses of objects too distant, and dim, to be seen through existing telescopes, and information on the objects that are acting as lenses.

Impressive because of how it was obtained. During an 8-month period, about 37,000 volunteers icombed 430,000 plus digital images in a huge, online photo library of deep space.

Automated computer programs have identified most of the 500 gravitational lenses on astronomer's books. However, computers failed to flag the 29 lenses the Space Warps volunteers spotted, speaking to unique skills we humans possess. ##

QUOTE:

"Robot exploration: a robot can only report things it's been programmed to report.

No! Footfall, boot prints in the dust, that's what we want!" - David Playfair.

The Moon Society – Lunar Frontier Settlement – www.moonsociety.org p. 4



ORGANIZED CHAPTERS All chapters listed below are joint Moon Society/National Space Society

Milwaukee Lunar Reclamation Society - http://www.moonsociety.org/chapters/milwaukee/ - http://www.moonsociety.org/chapters/milwaukee/ http://www.moonsociety.org/chapters/milwaukee/ http://www.moonsociety.org/chapters/milwaukee/ http://www.moonsociety.org/chapters/milwaukee/ http://www.space-Mlwaukee.com Contact: Peter Kokh - kokhmmm@aol.com - MEETINGS, 2nd Sat 1-4 pm monthly except July, August, At Mayfair Mall lower level Community room G150 for all meetings except December, in G110: Upcoming Meetings: JUN 11, SEP 10, OCT 8, NOV 12, DEC 10 (MLRS * MMM 30th Anniversary Banquet)

Moon Society St./NSS Louis Chapter - http://www.moonsociety.org/chapters/stlouis/

NSS St. Louis Space Frontier - http://StLouisSpaceFrontier.org/

http://www.meetup.com/Saint-Louis-Space-Frontier-Meetup/

Email Newsletter: St. Louis Space Frontier

Contact: Robert Perry <u>surfer_bob@charter.net</u> - Meetings Noon 4th Saturday of the month in room 162 of McDonnell Hall of Washington Univ. (2016) JUN 25, JUL 23, AUG 27, SEPT 24, OCT 22, NOV 26, DEC 24(/)

NSS/Moon Society Phoenix Chapter - http://nssphoenix.wordpress.com/ - c/o Mike Mackowski. http://nssphoenix.wordpress.com/ - http://nssphoenix.wordpress.com/ Meeting 3rd Saturdays monthly at Humanist Community Center, Mesa, 627 W. Rio Salado Parkway. NEXT MEETINGS (2016) JUN 18, AUG 20, SEP 17. At the April meeting, our own Mike Clark presented some of the aerospace news videos he produces for the on-line TMRO webcasts (https://www.tmro.tv)

At the May 21st meeting, Mike's talk asked the question "Whatever Happened to Single Stage to Orbit (SSTO)?"

Tucson L5 Space Society – Now serving Moon Society Members <u>www.tucsonspacesociety.org/</u> (not updated) <u>www.meetup.com/NSSPhoenix/events/161939572/</u> (not updated) Contact: Al Anzaldua – Meets monthly, every 2nd Saturday, 6:30 PM (2016) JUN 11, JUL 9, AUG 13, SEP 10, OCT 8, NOV 12, DEC 10

Clear Lake NSS/Moon Society Chapter (Houston) - http://www.moonsociety.org/chapters/houston/
Contact: Eric Bowen eric@streamlinerschedules.com - Meeting 7 pm 3rd Mondays of even # months in the conference room of the Bay Area Community Center at Clear Lake Park: (2016) JUN 20
Our April chapter meeting was rescheduled for Monday evening, April 25, 2016. Dr. Larry Friesen presented highlights from the recent LPSC 2016 conference.

Local Contacts

No Chapter in your area? If you are willing to be listed as a local contact, let us know and we can list you and the proposed chapter area (Zip Codes) If there are other members in the area we will let you know. Kokhmmm@aol.com

Non-geographic chapters

An option not pursued to date is for activity groups organized around a project or special area of interest rather than physical meetings. These can be temporary, focused on a specific project (such as the creation of our **Solar Power Beaming Desktop Demo Unit (2008)** – http://www.moonsociety.org/projects/spb-demo/online_kit/ Or a re-energized crew to work on our **Lunarpedia** – http://www.lunarpedia.org/index.php?title=Main_Page Or a group focused on creation of more realistic artwork of lunar outposts and settlements. The options are as wide as our collective talents. ##

Ken's Lunar Library (Ken Murphy, Moon Society President) http://www.outofthecradle.net/categories/lunar-library/

List of National Space Society Chapters - http://chapters.nss.org/a/lists/#US_Chapters

National Space Society Quarterly Magazine Ad Astra ("To the stars" - http://www.nss.org/adastra/
For past articles, Visit http://www.moonsociety.org/publications/mmm classics/ or /mmm themes/

JUNE 2016 SPACE NEWS BROWSING LINKS

SPACE STATIONS + ROCKETS + COMMERCIAL SPACE

www.space.com/32808-photos-spacex-jcsat-14-launch-rocket-landing.html

www.space.com/32813-orbital-targets-july-for-1st-flight-of-redesigned-antares-rocket.html

www.space.com/32873-boeing-first-starliner-crew-capsule.html

www.space.com/32899-glider-to-surf-sky-to-the-edge-of-space.html

www.nasa.gov/press-release/from-magnetoshells-to-growable-habitats-nasa-invests-in-next-stage-of-visionary

www.space.com/32999-nasa-inflatable-space-station-room-snag.html

EARTH + NEAR SPACE

http://phys.org/news/2016-05-van-allen-probes-reveal-long-term.html

 $www.spacedaily.com/reports/ \textbf{Climate_change_and_extreme_weather_linked_to_high_pressure_over_Greenland_999.html}$

moon

www.space.com/32787-strange-moon-swirls-origins.html

http://phys.org/news/2016-05-scientists-fresh-lunar-craters.html

MARS

www.space.com/32774-mars-rover-curiosity-mountain-climb-wheel-damage.html

www.space.com/32871-mars-methane-spike-curiosity-rover-mystery.html

http://phys.org/news/2016-05-world-moon-mars-veggies-dutch.html

www.marsdaily.com/reports/Are_mystery_Mars_plumes_caused_by_space_weather_999.html

http://phys.org/news/2016-05-ancient-tsunami-evidence-mars-reveals.html

http://phys.org/news/2016-05-martian-streaks.html

http://phys.org/news/2016-05-clues-volcanoes-ice-ancient-mars.html

www.spacedaily.com/reports/NASA_NSBRI_Select_Proposals_to_Support_Astronaut_Health_on_Long_Duration_ Space_Exploration_Missions_999.html

www.space.com/32882-nasa-crewed-mars-missions-resources-orbiter.html

www.space.com/33001-mars-ice-age-ending-now.html

http://phys.org/news/2016-05-potential-habitats-early-life-mars.html

http://phys.org/news/2016-05-scientists-evidence-ice-age-martian.html

ASTEROIDS + COMETS

 $\underline{http://phys.org/news/2016-05-\textbf{comet-craters literal-pots-life-earth}.html}$

www.nasa.gov/press-release/ launch-of-first-us-spacecraft-to-sample-asteroid-set-for-september- nasa-mediant and the sample asteroid as the sample asteroid as the sample asteroid as the sample as the sam

www.esa.int/Our_Activities/Space_Science/Rosetta/Rosetta_s_comet_contains_ingredients_for_life

OTHER PLANETS + MOONS

www.space.com/32832-new-mercury-maps-highs-and-lows.html

www.space.com/32913-jupiter-asteroid-impact-rate-fireballs.html

www.space.com/32995-jupiter-moon-europa-energy-life.html

www.space.com/32957-how-to-form-ios-mountains-just-squeeze.html

www.spacedaily.com/reports/Cassini_Spies_Titans_Tallest_Peaks_999.html

www.space.com/32886-exploring-saturn-moon-titan-via-submarine-spaces-deepest-secrets-clip.html

www.space.com/32844-saturn-moon-enceladus-surprising-plumbing-mystery.html

www.space.com/32778-pluto-hazy-layers-linked-to-gravity-waves.html

www.space.com/32834-pluto-behaves-more-like-a-planet-than-thought.html

www.space.com/32848-pluto-moon-hydra-water-ice.html

http://phys.org/news/2016-05-planet-world-shouldnt.html

ASTRONOMY + ASTROBIOTICS

www.nasa.gov/press-release/ nasas-kepler-mission-announces-largest-collection-of-planets-ever-discovered

http://phys.org/news/2016-05-science-instruments-nasa-james-webb.html

www.space.com/32956-sun-superflares-life-on-earth.html

www.space.com/32761-three-alien-planets-trappist-1-star-could-support-life.html

www.space.com/32852-alien-earth-search-nasa-kepler-space-telescope.html

www.space.com/32993-earth-like-exoplanets-too-hot-life.html

http://phys.org/news/2016-05-combined-climate-orbit-kepler-62f-sustain.html

www.space.com/32793-intelligent-alien-life-probability-high.html

http://phys.org/news/2016-05-aliens-easier-previously-thought.html

www.space.com/32870-3d-universe-map-confirms-einstein-general-relativity.html

MMM PHOTO GALLERY





Move over Tatooine! A planet found that has three suns!

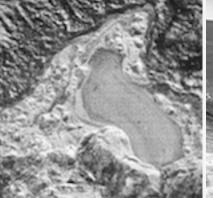




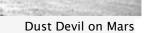
Underwater Hotel with space station like architecture



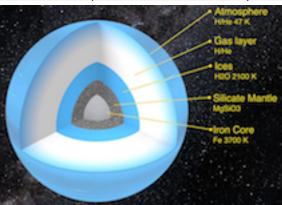
Moon Theme Hotel u.c. in Coachella Valley, Calif.



Lake of frozen nitrogen on Pluto



The colors in Europa's ice crust are ocean deposits

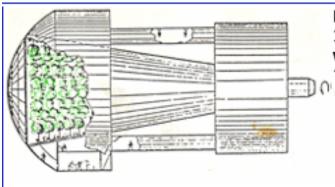


A guess at what Planet X may be like

pilot and one passenger Lynx may fly in 2017

Selections from MMM CUE IMAGES LIBRARY

http://moonsociety.org/publications/cue_images.html



Konstantin Tsiolkovsky's early 1900's concept for a space station with artificial gravity

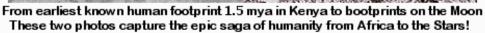
This concept featured the main requirements of a genuine oasis in space:

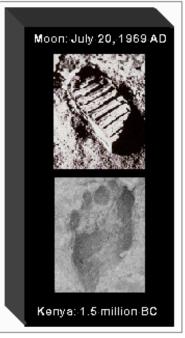
- · pseudo gravity
- · a fresh air cycle based on plant life

A central cone-shaped area admitted sunlight to levels of lessening "gravity" for testing. The "forest" area is shaded in green.

Many decades later in the 1970's. Gerard O'Neill and his followers popularized 3 main types of "Space Settlements": **Island One**: The Bernal Sphere, **Island Two**: The Stanford Torus, and **Island Three**: large cylinder – each an order of magnitude larger in population carrying capacity. O' Neill charged detractors with being "planetary chauvinists." But all three designs incorporated a serious operational handicap based on another unsuspected and unexamined "day-shift" chauvinism. Addressing this factor leads to some major and interstting new design features. **Read "Reinventing Space Oases"** http://www.moonsociety.org/publications/mmm_papers/reinv_so.htm









At right; a chunk of raw black glass made somewhere in the Middle East. On the Moon, we could take the regolith (moondust) as it is, in the highlands or maria "seas" heat it until it becomes liquid then shape it. Well mixed, the product would have a uniform color. in the light to dark gray range.

Unmixed, it might have a characteristic variation. Melted small breccia bits would make the product interesting. Crude but durable, raw glass production could provide settlement tableware as well as flower

pots and vases and objects of art. Using this near term technology to "lunarize" our living spaces, we will start to feel "at home."



For past articles, Visit http://www.moonsociety.org/publications/mmm classics/ or /mmm_themes/

NSS Chapters that share Moon Miners' Manifesto





Space Chapter HUB Webiste: http://nsschapters.org/hub/
Feature Page: Project Menus Unlimited http://nsschapters.org/hub/projects.htm

WISCONSIN



MLRS - Milwaukee Lunar Reclamation Society

PO Box 2101, Milwaukee, WI 53201 - www.Space-Milwaukee.com - http://www.meetup.com/Milwaukee-Space-Exploration-Meetup/

**Ad Astra per Ardua Nostra = To the Stars through our own hard work!

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• <u>James Schroeter</u> (414) 333–3679 – <u>james_schroeter@yahoo.com</u> TREASURER/Database • <u>Robert Bialecki</u> (414) 372–9613 – <u>bobriverwest@yahoo.com</u> (• Current Members of the MLRS Board of Directors)

Saturday, April 9th we celebrated Yuri's Night in our regular meeting, with a list of human firsts in space Meetings 2016: JUN 11, (summer break), SEP 10, OCT 8, NOV 12, DEC 10

WISCONSIN



SSS - Sheboygan Space Society 728 Center St. Kiel, WI 54042-1034

www.sheboyganspacesociety.org c/o Will Foerster 920-894-1344 (h) astrowill@frontier.com

SSS Sec./Tres. c/o B.Pat Knier dcnpatknier@gmail.org

DUES: "SSS" c/o B. P. Knier, 22608 County Line Rd, Elkhart Lake WI 53020

2016 MEETINGS: JUN 18, AUG 18, OCT 20, DEC 15- Call for location (920) 894-1344

Call for location (920) 894-1344

CALIFORNIA



OASIS: Organization for the Advancement of Space Industrialization & Settlement Greater Los Angeles Chapter of the National Space Society PO Box 1231, Redondo Beach, CA 902

Events Hotline/Answering Machine: 310-364-2290 - Odyssey Ed: Kat Tanaka <u>odyssey_editor@yahoo.com</u> <u>oasis@oasis-nss.org</u> - Odyssey Newsletter <u>www.oasis-nss.org/articles.html</u> Regular Meeting 3 pm 3rd SAT <u>monthly</u> - 2016 Schedule Jun 18 - Sep 17 - Oct 15 - Nov 19 - Dec 17

COLORADO



DSS: Denver Space Society fka Front Range L5
1 Cherry Hills Farm Drive, Englewood, CO 80133
http://www.denverspacesociety.blogspot.com/

James W. Barnard 303-781-0800 trailrdr@ecentral.com - Monthly Meetings every 3rd Thursdays, 7 pm
Englewood Public Library, Englewood, CO 80110 - 1000 Englewood Parkway, 1st Flr Civic Center
2016: Jun 16, Jul 21, Aug 18, Sep 15, Oct 20, Nov 17, Dec 15

For past articles, Visit http://www.moonsociety.org/publications/mmm_classics/ or /mmm_themes/

ILLINOIS



LDAhean@aol.com

CSFL5: Chicago Space Frontier L5 - 610 West 47th Place, Chicago, IL 60609

MINNESOTA

MSFS: Minnesota Space Frontier Society - http://www.mnsfs.org
c/o Dave Buth, 433 South 7th St. #1808, Minneapolis, MN 55415
c/o Dave Buth, 433 South 7th St. #1808, Minneapolis, MN 55415

MNSFS monthly meetings are held on the first Thursday of each month at the Fairview Community Center (Great Room), 1910 County Road B West, in Roseville, MN 55113 Meetings usually start at 7:00 p.m. and last about two hours. Each meeting features Board member introductions, general announcements,

<mark>2016 Schedule</mark> Jun 2 - Jul 7 - Aug 4 - Sep 1 - Oct 7 - Nov 4 - Dec 1

OREGON



Oregon L5 Society - http://www.OregonL5.org PO Box 86, Oregon City, OR 97045

(LBRT - Oregon Moonbase) moonbase@comcast.net - Charles Radley: cfrjlr@gmail.com

Meetings the 3rd Sat of the Month at 2:00 PM - 2016 Schedule Jun 18 - Sep 17 - Oct 15 - Nov 19 - Dec 17

PENNSYLVANIA



NSS-PASA: NSS Philadelphia Area Space Alliance

c/o Earl Bennett, <u>Earlisa t@verizon.net</u> - 856/261-8032 (h), 215/698-26 00 (w) http://pasa01.tripod.com/ - http://phillypasa.blogspot.com

Meetings 3rd Thurs 2016 JUN 16, JUL 21, AUG 18, SEP 15, OCT 20, NOV 17, DEC 15

The NSSPASA Report for May 2016

Meeting times and locations: Our June and July meetings will be at The Liberty One Food Court. June meeting will be on Saturday, June 11, the July meeting will be on Sunday, July 10. No events scheduled in these two months.

We had a well attended meeting with several of our regular attendees taking care of other matters. If you have attended the I.S.D.C. in Puerto Rico you probably met Dennis Pearson the Region & Organizer.

Larry, our webmaster, brought the latest statistics and updates on our websites and the code that he wrote to make the website more attractive. To see what he has done visit our website(s) and check with him on how he created things like "time awareness" as part of the sites customer utility. He has also included some astronomical data on phases of the Moon.

Dorothy gave us the latest brochure on The Baltimore Science Fiction Convention, the 50th, and what will have happened there. About a quarter of our members will attend this great combination of fiction, fantasy, and, hard science. The convention has drawn on the many science and technology organizations in the Washington D.C. area with guests from around the globe. George R.R. Martin is the Guest of Honor overall, and Kim Stanley Robinson is there as The 2016 Robert Heinlein Award winner. There is over 400 hours of activities this year. Dorothy also brought material on The Baltimore Science Museum and its' schedule of movies and events including several Star Trek movies starting June 5th. And there was also a schedule for the Goddard Visitors center with an inclement weather warning: the center will be closed if the Goddard Space Flight Center is closed.

For more go to goddard-visitor-center-program@lists.nasa.gov.

Hank, who planned to be at Balticon, noted that A world Con and a NASFIC can occur on the North American continent at the same time. Hopefully I have got this right finally. The meeting of P.S.F.S., the local science fiction organization, he was going to report on was moved and he will report on there activity and what's coming for Philcon this fall. He pointed out that we may have a N.A.S.F.I.C. here next year: this could happen in Valley Forge in the Sheraton there. This is a very nice location next to the Valley Forge Park. There is upscale shopping at nearby King of Prussia, and, access to the Main Line and Regional Rail there. Hank has plans for 2017: he has a membership for the World Con in Finland! This would really be very cool if it happens for him.

Mitch talked about a number of areas and suggested that P.S.F.S. get a table for next years' Science Festival and Carnival. There is a charge, if the non-profit organization does not perform some worthwhile educational outreach in the Philadelphia area. He brought the Summer issue of Ad Astra for several members and the May issue of The Smithsonian magazine which covered a number of space reports including on Bigalow Aerospaces ideas for a space hotel and other structures, and eventually moving beyond orbit and going to the Moon and Mars with them. And N.A.S.As. Grand Plan for space exploration. And "Next Stop: Mars". Mitch also reported more on our very successful outreach events in April, culimating in the Science Carnival activities on The Grand Plaza site. It should be noted that although we did participate in several events we were only a part of the much grander Festival that was held in Philadelphia throughout the week in late April. There are plans to hold the event next year and it would be great if we are invited again. I suspect that Mitch will be very happy to see that we are included (he did all the work to make this happen for us).

Janice brought a new issue of Science, April 8, with a rather long and precise title: "Observational Constraints on Mixed Phase Clouds Imply Higher Climate Sensitivity". The clouds can cause a 2 to 13 degree variation in the ground temperature. This factor has not been factored into the climate change studies. The temperature measurements are from satellite data (and other sources I suspect).

Wallace visited RavenCon this year and plans to attend the Science Carnival instead next year. He recommends:

"Space Shuttle Columbia: Mission of Hope" and the story of the Torah that was taken on the mission by astronaut Ilan Ramon. All was lost in the Columbia disaster.

Earl brought a number of reports and material on several topics: one area in particular was of interest to our members: there is a plan to send probes to Alpha Centauri and beyond. As mentioned last month a Russian billionaire, Yuri Milner, is planning to finance part of the effort with \$100 million dollar as seed funding. The whole project will cost billions of dollars and take several decades to work: one of the reporters on this, Tariq Malik (Managing editor, Space.com) reported that the "Star Shot Probe" would only take 20 years to reach the Alpha Centauri system. His report includes comments by one of the advocates of this effort, Stephen Hawking, "The Limit that confronts us now is the great void between us and the stars, but now we can transcend it". This report includes Milners' comment that the craft, could be accelerated to 20 percent of the speed of light, which could let it reach Alpha Centauri in the time indicated. This report mentions that "the target body, a wafer size chip, would be attached to a super thin sail. Another report from Space. Com discusses the uses of the early engineering test units to be used as "intra- stellar" (between the stars) exploration devices and outer (and inner?) planet probes. The "outer planets" would actually be the moons of the giant planets Jupiter and Saturn. Imagine a swarm of probes, ala N.A.S.As 1990 studies and onward, of small interdependent probes that could collect data over a large area of a target. Since they will be mass produced, like semiconductor systems, and they are of very low mass, a relatively modest launching device could push them toward various "local" targets. Pluto could be a test case for a fast transit probe(less than a year say) when the lasers are prototyped. If the launch covered a distance of ten billion miles we would have to push the craft to 317 miles a second (I assume a trivial acceleration time, per this and other related articles speculations) and we could get a lot of back ground data about Pluto. And the probes would keep going into the Kuiper Belt and beyond. We would get good practice with this effort in the next decade. Since we are building systems that will be integrated from various places there will be a need for some organization to be set up, or substantial beefing up of an existing one, to run this. I think Yuri and the other backers could do worse than use proven groups to study and learn from for the effort. Some of the people from The old World Space Foundation could be consulted on what can become problems during development as well as those organizations that have done successful launches in the last two decades. If you go to Space .com you will find more on the recent efforts to get this project going. Maybe with the backing of Mr. Milner "we" will get something done this time. I will write a background article on the subject of Solar Sail projects separately.

In other areas: From N.A.S.A Tech Briefs for May: "R.F. Source Modifications to Improve Performance of an lector Negative Thruster" by a team from Georgia Tech for the Marshall Space Flight Center. The technique they developed increases the efficiency of the ionization part of the engine and this improve the overall performance of the engine. There improvement cuts the energy cost of the system which is a different version of the lon Thruster that is being talked about for Mars flights. See the article on page 20 for a better explanation and contact information on this technology (and look up the reasoning behind why an electro negative plasma thruster is desirable in general). And recently (mid May) in the news: N.A.S.A. has announced that it will research techniques to give astronauts the ability to sleep up to two weeks at a stretch. This was announced by Principal Investigator John Bradford of Spaceworks Engineering . And a representative of Lockheed Martin was interviewed, briefly, on that companies' plans for Mars by 2028. The women who did the presentation described the teleoperation concept that they want to implement: a base would be set up on Phobos initially to give quisi real-time control of rovers and landers without the need to put crews on the ground at first. As described we could use a surface lab for much of the analysis and even bring samples up to Phobos, for human scrutiny, if further investigation seems warranted. N.A.S.A. was not mentioned during the interview. Maybe this will be a private effort that would not require the battles in congress that has weakened many other efforts, even nearly killing the Space Station at one time, so something will go forward close to schedule.

And India has just tested a mini shuttle of its own! Yeah! Submitted by Earl Bennett, President, NSSPASA, KD2CYA.

Moon Miners' MANIFESTO Milwaukee Lunar Reclamation Society, Inc. PO Box 2102, Milwaukee, WI 53201-2102





Please renew promptly so as not to miss an issue Address Service Requested -->> Mail Carrier, Time Sensitive Material

INDEX to MMM #296 June 2016

- 2 In Focus: The need to develop faster rockets, much much faster! Peter Kokh
- 3. Jupiter and its moons: what we have learned and still need to learn Peter Kokh
- 4. Saturn and Titan: what we have learned and still need to learn Peter Kokh
- 5. Uranus and Neptune and their moons What we have learned and still need to learn Peter Kokh
- 6. "Astronomy" and "Space Apps" for Smart Phones & Tablets Peter Kokh
- 7. Making it on Mars Dave Dietzler
- 8. Journey to Another World: A Cascade Space Walk poem by Robert McGowen

Moon Society Journal Section

9. The Ptesodemt's message

11. Items of Interest, cont.

13. Browsing Links – Video Links

15. Images from MMM Cue Gallery

10. Items of interest

12. Chapter & Outpost News

14. MMM Photo Gallery

16. 2017 ISDC in St. Louis

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