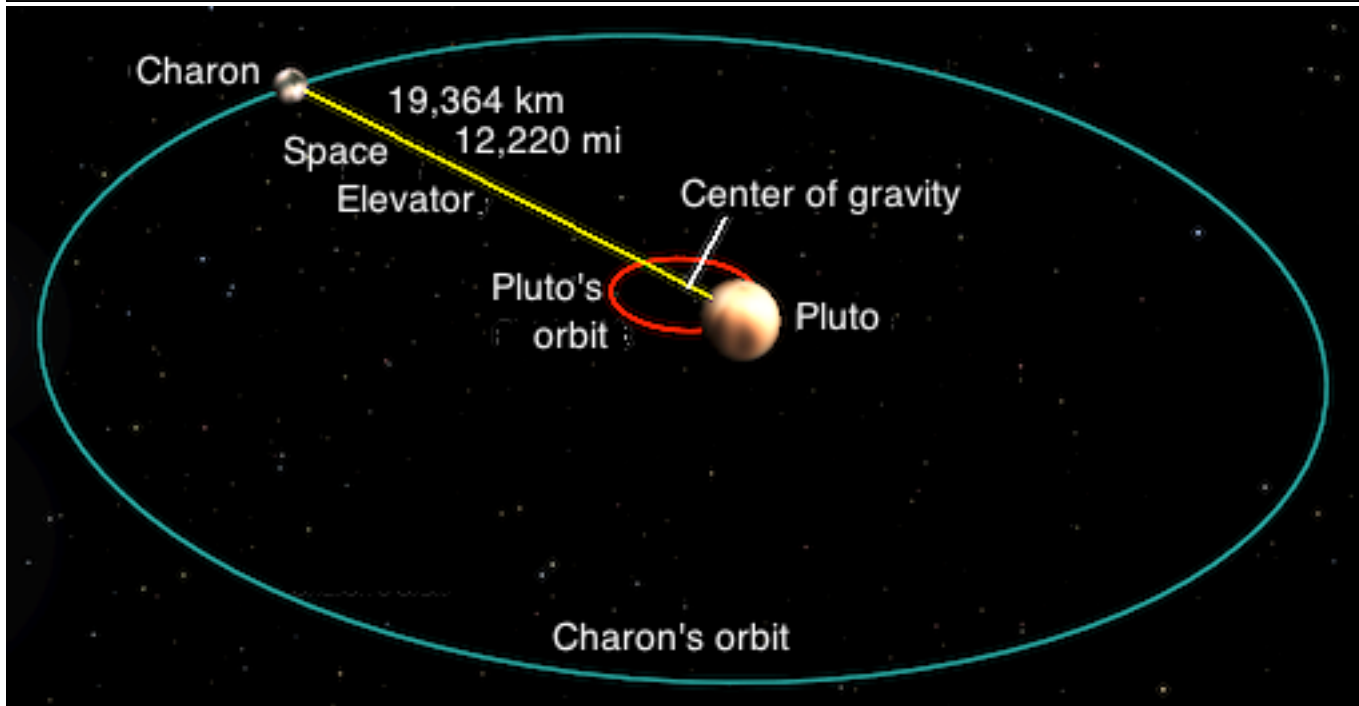


“Towards an Earth–Moon Economy – Developing Off–Planet Resources”

# Moon Miners’ Manifesto

& The Moon Society Journal

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The Pluto–Charon “Binary Planet” System – 1/20<sup>th</sup> as far apart as Earth and Moon

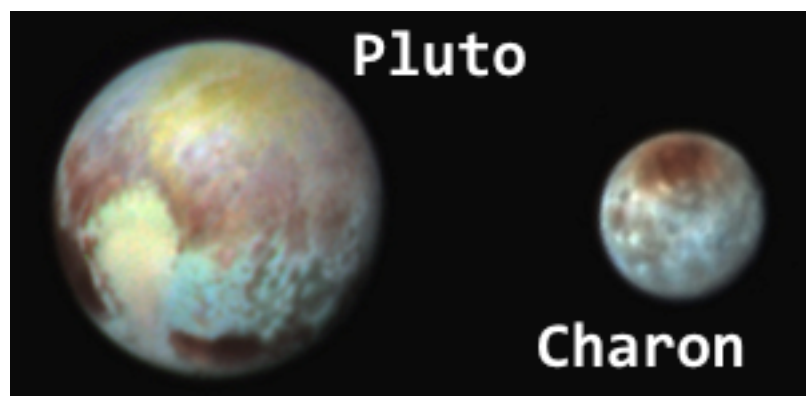
Do watch the Video! [http://upload.wikimedia.org/wikipedia/commons/6/6c/Pluto-Charon\\_System.gif](http://upload.wikimedia.org/wikipedia/commons/6/6c/Pluto-Charon_System.gif)

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Not a “dwarf planet” with a “moon” but a “Binary Planet” revolving around a common center of gravity

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

## In Focus NASA missions should all carry Cubesat secondary probes

By Peter Kokh

I had intended to write this editorial, but happily, NASA had “read my mind” and, no doubt, those of many others. [www.nasa.gov/press-release/nasa-prepares-for-first-interplanetary-cubesats-on-agency-s-next-mission-to-mars/](http://www.nasa.gov/press-release/nasa-prepares-for-first-interplanetary-cubesats-on-agency-s-next-mission-to-mars/)

Planetary missions, whether orbiters or landed rovers, are expensive. So why not get more for our taxpayer bucks by requiring NASA to carry along any cubesats intended for the same destination? The extra cost will be little in comparison to the possible discoveries made by these ever more sophisticated lightweight gizmos.

Wouldn't it be nice if New Horizons had carried along a lander for both Pluto and Charon, designed to tell us about the surface chemistry of these two intriguing sister planets? Wouldn't it have been nice if the Curiosity mission could have landed a cubesat on a Martian polar ice cap to analyze the chemical and isotope mixes in the polar ice? Wouldn't it be nice if Dawn carried along a cubesat lander with an open mission, which could be landed in one of Ceres intriguing white spots.

Why not more than one cubesat? Mission slots are hard to come by. Adding one or more cubesats aimed at complementary science at the same destination, could tell us more, much sooner. What we are learning about the solar system is phenomenal. But with a mandate from Congress, we could be learning more, and sooner. PK

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## Powering a Moon base through the lunar night

The Sacramento L5 Society et al – April 23, 2015

What's the most practical way to sustain a permanent Moon base through the approximately 355 hour lunar night? In 2009, a NASA concept study attempted to answer that question, according to a recently discovered slideshow<sup>1</sup>. And in March of 2014, the Sacramento L5 Society (SL5S), a California chapter of the National Space Society, undertook the task of answering the same question, eventually resulting in a detailed analysis of 20 different potential energy delivery systems. From examination of the 2009 NASA study fragments, it seems likely that the SL5S analysis has uncovered several relevant concepts that were not considered by the NASA concept study, specifically the use of aggressive laser collimating, solar pumped lasers, orbiting energy storage, beam deflecting systems, multiple linked solar converters at the lunar poles, and solar sails for station keeping.

This article is a summary of the findings of the SL5S analysis to date. The detailed analysis itself and its accompanying spreadsheet, including a full description of the 20 systems the SL5S has studied to date, can be found on the SL5S website<sup>2</sup>.

### Lift Capacity (LC)

Because it takes less force to put a given mass into LEO than into lunar orbit, and less force to put a mass into lunar orbit than onto the lunar surface, it is useful to use a given LC to determine relative masses of different systems in different locations. In the SL5S analysis, the LC is defined in SpaceX Falcon Heavy (FH) units. One FH has a liftoff mass of 1,462,836 kg<sup>3</sup>. It is assumed that the LC of one FH can put 53,000 kg into Low Earth Orbit (LEO), 17,216 kg into either a lunar or L1 orbit, and 5,739 kg onto the lunar surface.

### Electric Propulsion system (EP)

Mass doesn't necessarily have to be lifted directly from Earth to its final destination. Called FAST (Fast Access Spacecraft Testbed) in the 2009 NASA study, use of an EP reduces the LC of any given system. For the SL5S calculations, it is assumed that the propellant and EP drive used to move a mass from LEO to either LO or L1 will equal 30% of the transported mass. Since moving a mass that distance with a standard rocket approach will typically take about twice the transported mass in fuel, the potential savings are clear.

An EP system can also be used for "orbital station keeping," which can be broadly defined as maintaining an object in space in a preferred position or orbit. The 2009 NASA study included mass calculations for station keeping which have been used in the full SL5S analysis.

### Energy storage systems and an Emergency Backup power System (EBS)

The SL5S analysis examined energy storage by flywheel, electric battery, chemical, and thermal battery systems. It was concluded that Lithium-Sulfur (Li-S) batteries presently appeared to have the best specific energy (0.5 kWh/kg)<sup>4</sup>, but that other systems would benefit greatly from In Situ Resource Generation (ISRU) and would become competitive fairly rapidly once manufacturing on the lunar surface began. A specific energy of 0.5 kWh/kg has been used in the SL5S analysis as the basis for energy storage mass calculations for all systems.

Clearly, systems that rely more on energy storage will be more positively affected by any future improvement in energy storage technology. However, all systems will be positively affected to some degree, since all systems would need some minimum amount of backup power in case of emergency. In the event of a total Moon base energy system failure, such an EBS would need to be adequate to permit evacuation of the Moon base personnel to a safe habitat, probably Earth. Also, sufficient backup energy would need to be available to effect repairs, if at all possible. In this analysis, a prudent backup quantity is assumed to be 120 kWh for a (nighttime) 15 kW continuous Moon base energy system. Using Li-S, the mass of the EBS would equal about 240 kg on the lunar surface.

### Laser collimating

Aggressive collimation of the laser beam with a Fresnel optical lens could be used to dramatically reduce the diameter of a laser beam over a long distance since, for a given light wavelength and distance to target, spot diameter is inversely proportional to aperture diameter.<sup>5</sup> Per one source, "If we collimate the output from [a] source using a lens with focal length  $f$ , then the result will be a beam with a radius  $y_2 = \theta_1 f$  and divergence angle  $\theta_2 = y_1/f$ . Note that, no matter what lens is used, the beam radius and beam divergence have a reciprocal relation. For example, to improve the collimation by a factor of two, you need to increase the beam diameter by a factor of two."<sup>6</sup>

Accordingly, it is highly recommended that aggressive collimation be explored as a means of decreasing the divergence angle of a laser beam. Aggressive collimation may be especially practical in a weightless, weatherless environment. Because objects in space are weightless, and because space has no atmosphere, a space-based Fresnel collimating lens might only be a few mils thick. Also, it should be easier to make a high precision Fresnel lens than a high precision parabolic mirror, since it's only the thickness of the film, as a function of distance from the center, that needs to be precise to a fraction of a wavelength. Further, the film can likely warp or twist to some degree without affecting its beam-forming ability. Finally, a Fresnel lens has a higher light transfer efficiency than a mirror. In this analysis, the mass of a Fresnel lens laser collimator, including the mounting framework, is assumed to be 0.25 kg/m<sup>2</sup>, with most of that mass assumed to be in the mounting framework.

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### Solar Pumped (SP) Laser System (LS)

The LS system analyzed in the 2009 NASA study was a PV-powered LS. Another type of LS is possible using SP lasers<sup>7</sup>. In an SP LS, the solar insolation is concentrated directly on the laser, bypassing the electrical conversion system. Efficiencies for the SP LS and the PV LS are expected to eventually be about the same, but the SP LS appears to have a higher specific power even at present efficiencies.

### Orbiting Energy Storage system (OES)

A satellite that is not in sun synchronous Lunar Orbit (LO) will move continually into the Moon's shadow. Adding an OES system permits an orbiting LS to continue beaming energy even when this occurs. This permits a completely different approach to using an orbiting LS to power a Moon base than was considered in the 2009 NASA study, where the Moon base only received beamed energy when the LS was both in line of sight with the base and in full sunlight.

### Deflecting satellite System (DS)

Use of DS satellites can in certain circumstances permit uninterrupted LS beaming, thus obviating the need for energy storage either in orbit or on the lunar surface. In one proposed system, an LS is orbited in a sun synchronous polar orbit such that it continually sees solar insolation throughout the year. Two, three, or more laser-deflecting satellites are placed in the same polar orbit and all satellites are spaced an equal distance apart. The satellites are able to deflect the laser beam either to another satellite or directly to a Moon base at the one of Moon's poles, thus continually powering the Moon base and obviating the need for energy storage. Adding a "constellation" of orbiting LS satellites with different orbits would make it possible to continually direct a laser beam to any point on the lunar surface.

A DS can also find use in other ways. Orbiting a DS constellation around the Earth would permit an LS, mounted either in LEO or even on the Earth's surface, to continually transmit laser energy to the Moon, including continually transmitting laser energy to a second DS constellation orbiting the Moon. Also, it is possible to use a series of non-orbiting DS modules directly on the lunar surface to transfer beamed energy to other locations. Finally, it is possible to mount laser systems at the lunar poles and beam solar-powered laser energy to orbiting DS constellations, distributing lunar pole-generated laser energy to Moon bases anywhere on the Moon.

### Lunar Polar Multi-array System (LPMS)

The LPMS assumes that a 15 kW continuous polar Moon base can be operated with three separate PV arrays situated on high lunar mountain peaks, or so-called "peaks of eternal light,"<sup>8</sup> each connected directly to the base via multi-kilometer long electric cables. Periods of darkness as long as 36 hours are still likely<sup>9</sup>, requiring an estimated additional energy storage capacity of 540 kWh. Peak power output capacity of the three PV arrays would thus occasionally equal 45 kW.

As an alternative to energy transfer by electric cable, it may be possible to deflect and transfer solar beams directly to a Moon base from multiple distant (polar) sites. The transfer would be accomplished with a series of surface-mounted DS modules, each module composed of an arrangement of lenses and mirrors. Estimates of the mass and efficiency of such solar beam deflection systems are currently in process.

### Solar Sail Propulsion System (SSP) and the Gravity Winch

In certain circumstances, a solar sail arrangement can be used to enhance or even replace an EP system. An SSP is advantaged over an EP because of its ability to modify a spacecraft's position without using fuel. A related idea is the use of reels to pull in or let out either solar sails or "gravity anchors" relative to a space-based LS platform. This constitutes what might be called the concept of a "gravity winch". A gravity winch is basically a reeled tether that's dropped down a gravity well from a neutral gravity point such as L1. In the case of an L1LS, a tether can be dropped down both the Moon's gravity well and Earth's. Shifting the gravity anchors from one side to the other allows the L1LS to "balance" between the two gravity wells, similar to the way a pole helps a tightrope walker balance. In effect, it removes the "z" vector (along the Earth-Moon axis) from consideration, allowing station-keeping to concentrate on the "x" and "y" vectors.

Figures 1–3 illustrate a possible space-base L1LS that uses a solar sail and a gravity winch for station-keeping. Figures 1 and 3 show the position of the solar sails and the rotating reflecting mirrors when the Moon is directly between the Sun and the Earth. Figure 2 shows the position of the solar sails and the rotating reflecting mirrors when the Earth is directly between the Sun and the Moon. Figure 3 is a close-up showing the main framework, the main boom, the system of rotating and non-rotating reflecting mirrors, two arrays of collimated solar-pumped lasers, and the tether winches.

### The 2009 NASA concept study

The preferred system recommended in the 2009 NASA study was a PV solar array-powered Cryogenic storage Regenerating Fuel Cell system (CRFC). NASA calculated that a 5 kW continuous delivery CRFC system would store 2,000 kW-hr with a system energy density of 1.15 kWh/kg. The study's alternate preferred system was a Fixed Orbit Laser System (FOLS) with a 16.1 hour orbit period that required a surface receiver installation with 525 kW-hr of energy storage. The laser was powered and fired (a) when it was in direct sunlight, and (b) whenever it was in direct line of sight with the Moon base.

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The 2009 NASA study's FOLS system analysis presumed an energy storage architecture that was capable of only 200 W-hr/kg. If the NASA study had used the proposed 1.15 kWh/kg CRFC to store the energy for the proposed FOLS, then the total estimated FOLS energy storage system mass would have been reduced by 83%, making a comparison between the two systems far more competitive. A probable reason for not including this consideration was that NASA was pitting the two technologies against one another to determine which development program would be funded.

Systems	Comment	Tot FH with EP	Tot FH without EP	Tot FH \$ with EP	Tot FH \$ without EP
ELEOLS	Beamed energy from Earth to a DS constellation in LEO	0.11	0.18	\$6,994,393.08	\$11,648,264.06
LOPMLS (SP)	LO Polar Multiple satellite LS - SP-powered	0.08	0.19	\$5,148,061.71	\$11,880,142.41
EGEOLS	Beamed energy from Earth to DS at GEO	0.09	0.20	\$5,644,184.77	\$12,421,191.89
L1LS (SP)	L1 based LS - SP-powered	0.09	0.20	\$5,509,163.93	\$12,713,455.23
LEOLS (SP)	Low Earth Orbit LS - SP-powered	0.13	0.20	\$8,489,042.29	\$12,797,994.22
LEOLS (PV)	Low Earth Orbit LS - PV-powered	0.14	0.21	\$9,101,346.06	\$13,268,997.12
LOPMLS (PV)	LO Polar Multiple satellite LS - PV-powered	0.09	0.21	\$5,760,365.48	\$13,293,151.11
LOPCLS (SP)	LO Polar Constellation satellite LS - SP-powered	0.09	0.21	\$5,901,666.35	\$13,619,230.04
L1LS (PV)	L1 based LS - PV-powered	0.10	0.23	\$6,388,369.35	\$14,742,390.81
LOPCLS (PV)	LO Polar Constellation satellite LS - PV-powered	0.10	0.24	\$6,513,970.12	\$15,032,238.75
L1LS (PV)	L1 based LS - PV-powered	0.11	0.25	\$6,953,572.83	\$16,046,706.53
LOPPVLS (PV)	LO Polar single satellite LS - PV powered	0.11	0.26	\$7,032,073.32	\$16,227,861.50
LOEPVLS (PV)	LO Equator single satellite LS - PV powered	0.12	0.29	\$7,912,848.74	\$18,260,420.17
L5LS (SP)	L4 or L5 based LS - SP-powered	0.46	0.46	\$29,541,301.96	\$28,992,040.12
L5LS (PV)	L4 or L5 based LS - PV-powered	0.49	0.48	\$31,378,213.28	\$30,405,048.82
LPSMS (PV)	Lunar Polar Surface-Mounted System - PV-powered	0.27	0.63	\$17,427,107.34	\$40,216,401.57
LOSPLS (SP)	LO SP-powered LS	0.36	0.82	\$22,702,339.84	\$52,390,015.01
LOPVLS (PV)	LO PV-powered LS	0.37	0.85	\$23,455,944.48	\$54,129,102.65
CRFC*	Cryogenic storage Regenerating Fuel Cell system - *Applicable to all systems requiring energy storage if practical	0.39	0.89	\$24,515,701.01	\$56,574,694.83
FOLS	Fixed Orbit Laser System - PV-powered - 2009 NASA concept study	0.96	2.22	\$61,187,986.90	\$141,203,046.68
LNSMS (PV)	Lunar Non-polar Surface Mounted System - PV-powered	0.99	2.28	\$62,808,236.88	\$144,942,085.10



## Findings

**Table 1**, entitled "Moon energy systems lift capacity in Falcon Heavy units and dollar equivalents," collates the results of our analysis. The CRFC and FOLS systems are included for reference purposes only. It is presumed that any advances in battery technology will be applied across the board to all systems. To aid in such, a comparable system to the CRFC system but using Li-S energy storage is included as the Lunar Non- polar Surface Mounted System (LNSMS). Also, a comparable system to the FOLS system but using Li-S energy storage and aggressive laser collimating is included as the Lunar Orbiting PV-powered Laser System (LOPVLS).

In Table 1, the systems are shown ranked from low cost to high cost by the column "Tot FH \$ without EP". It is assumed that, for an initial Moon base, electronic propulsion will not be used to deliver the payloads to their ultimate destinations. FH dollars are calculated based on \$1,200/kg in accordance with the statement by SpaceX Chairman Elon Musk that "Ultimately, I believe \$500 per pound or less is very achievable"<sup>10</sup>. It's important to note that FH dollars do not include any costs associated with developing the various systems shown in the table.

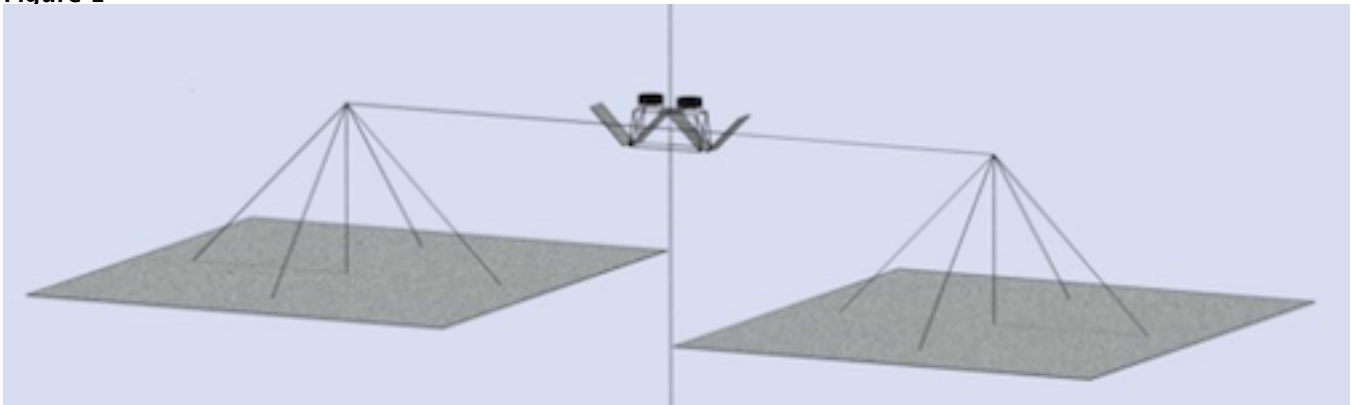
## Conclusions

The findings of the SL5S analysis are very much first order approximations. In addition, the analysis is still a work in progress. However, in light of the dramatic nature of those findings, it is felt that the systems in question merit a far more in-depth analysis than the S5LS is capable of delivering. It is hoped that this article will inspire the undertaking of such an in-depth analysis by NASA or some other interested party, to the benefit of all who dream of mankind moving outward into the universe.

## History of this analysis

In early 2014, two college students, Akhil Raj Kumar Kalapala and Krishna Bhavana Sivaraju of Rajiv Gandhi University, India, proposed beaming space-based solar energy to the Earth by way of a laser beam located in geosynchronous orbit<sup>11</sup>. On March 14, 2014, an informal "brown bag" Moon Base Working Group (MBWG) was begun at NASA/Ames at Moffett Federal Airfield in California "to develop a cost-effective plan for establishing and operating the NASA Moon Base that would be within 10% of the total NASA budget." In March of 2014, Joseph Bland of the Sacramento L5 Society (SL5S), one of the mentors for Akhil and Krishna, suggested to Michael Abramson, a member of both the SL5S and of the NASA/Ames MBWG, that the group examine the possibility of powering a Moon base through the lunar night with a laser either at L1 or in lunar orbit. It was later discovered that use of a LS at L1 had been proposed by others, including Charles Radley, president of the Oregon L5 Society<sup>12</sup>.

**Figure 1**



**Figure 2**

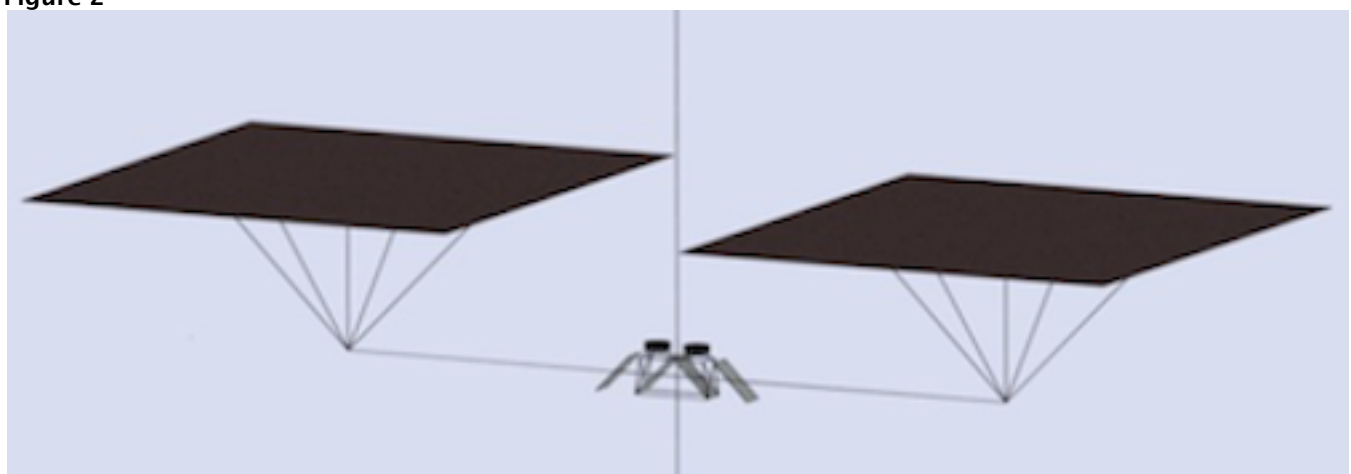
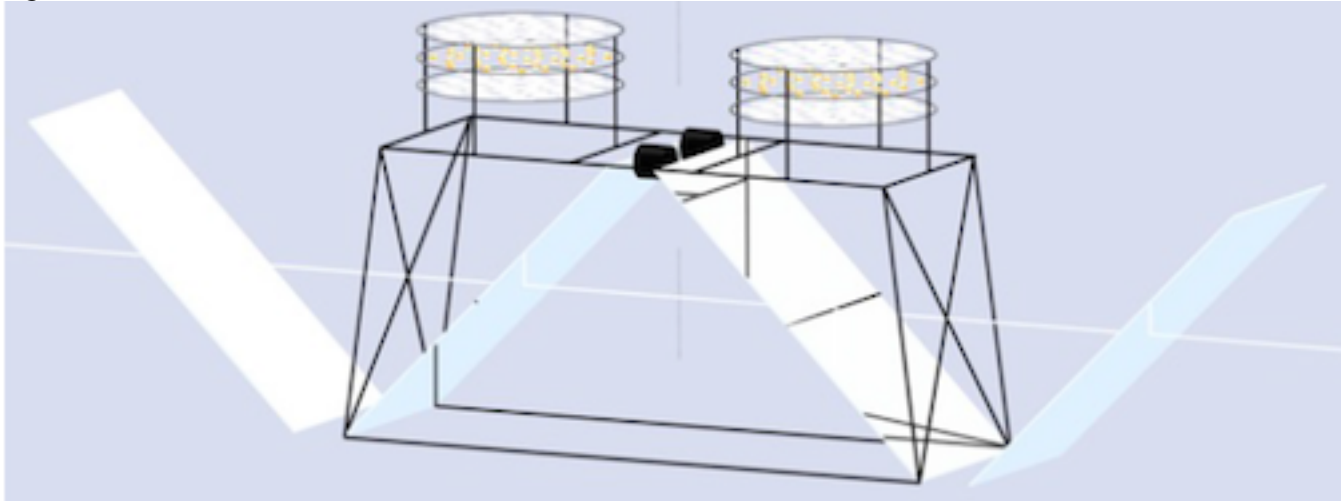


Figure 3



- 1 [http://www.nasa.gov/pdf/315858main\\_Cheng-yi\\_Lu.pdf](http://www.nasa.gov/pdf/315858main_Cheng-yi_Lu.pdf)
- 2 [sac15.org](http://sac15.org)
- 3 [http://en.wikipedia.org/wiki/Falcon\\_Heavy](http://en.wikipedia.org/wiki/Falcon_Heavy)
- 4 <http://www.gizmag.com/lithium-sulfur-battery-energy-density/29907/>
- 5 SL5S member Roger Arnold
- 6 <http://www.newport.com/Focusing-and-Collimating/141191/1033/content.aspx>
- 7 [http://www.asteroidinitiatives.com/Papers/files/Solar-pumped-laser-white\\_paper.pdf](http://www.asteroidinitiatives.com/Papers/files/Solar-pumped-laser-white_paper.pdf)
- 8 [http://en.wikipedia.org/wiki/Peak\\_of\\_eternal\\_light](http://en.wikipedia.org/wiki/Peak_of_eternal_light)
- 9 <http://ntrs.nasa.gov/search.jsp?R=20120010094>
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- 11 <http://spacejournal.ohio.edu/issue18/helioastra.html>
- 12 <http://lunarelevator.com/wp-content/uploads/2014/07/NASA-Lunar-CATALYST-Final.pdf>

For the Original Paper, go to [www.SacL5.org](http://www.SacL5.org) and click on the tab next to Home titled “Moon Base.” There you will find this article, along with the 37 page analysis upon which the article is based, and also Appendix 1 of that analysis.

Editor: Kudos to the Sacramento L5 Society NSS chapter for this fine paper!

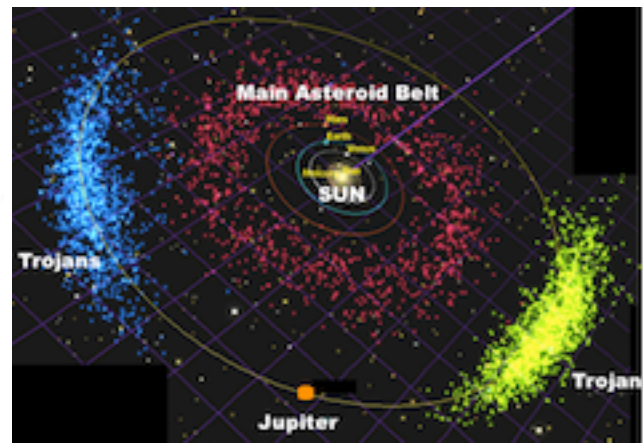
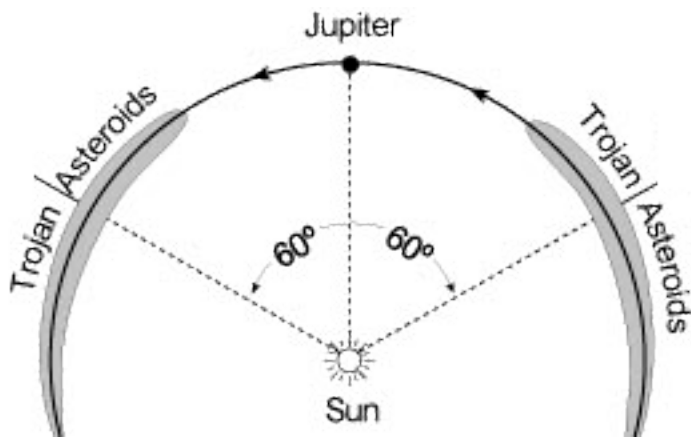
## The Truth about the amazing Pluto-Charon “Binary Planet” system

### BOGUS STANDARDS: “CLEARING ITS ORBIT”

Famed astronomer **Neil Degrasse Tyson** has defended the current misclassification of Pluto (not even correctly calling it “Pluto-Charon”) on the “official” claim that **“Pluto has not cleared its orbit of asteroidal type debris.”**

- Every planet’s orbital region situation is different. The further from the Sun, the volume to be “cleared” grows exponentially, perhaps fair for the massive “gas giants” – Jupiter, Saturn, Uranus, and Neptune – but hardly for a small body such as Pluto.
- Indeed, if Pluto were as big and massive as Earth, by these “official standards” it would still be denied planetary status, as Earth, placed in Pluto-Charon’s orbit, would not have satisfied this bogus standard either.
- One could argue that **only Jupiter has cleared its orbits to the extent that it has marshalled orbital debris in its “orbital region” into “Greek” and “Trojan” clouds** 120 degrees ahead and behind the planet in its orbit around the Sun. Actually, we have found a sparse few Trojans in the orbits of Uranus and Neptune, but hardly “clouds” of them in the orbital domain of either,
- As a “popularizer,” Tyson has done us all (and his own reputation) a disservice by endorsing the “official” view of a fraction of astronomers still attending the conference where this rubric was proclaimed, after 5/6<sup>th</sup> of the astronomers attending had left for home. “Truth” is more important than “the Party Line.”
- One could also argue that **any planet’s surface saturated with impact craters, is testimony that the planet has indeed “been clearing” its orbit: an ongoing process.**

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## TWO QUESTIONABLE STANDARDS

- One “legitimate argument” that Pluto-Charon should not be included in the family of “Planets” is that this binary planet’s orbit around the Sun is “**significantly out of the plane**” in which the other 8 planets are found.
- **Orbital inclination** of the Other Eight: 0° to 7° (Mercury, the innermost) to Pluto-Charon 17° – **on what grounds is Mercury’s 7° okay, and Pluto-Charon’s 17° not okay?**

[Note: it may be traditional to use Earth’s plane as the standard, but this is also illegitimate. Why? 75% of the orbital momentum of the entire Solar System, Sun included, is in Jupiter’s orbital plane, not Earth’s!]

- The other rubric is that Pluto-Charon’s **orbital eccentricity is significantly out of the range** of orbital eccentricities of the other eight planets. **On what grounds is Mercury’s orbital excentricity of 0.21 okay and the 0.25 of Pluto-Charon not okay?**
- It would seem far more likely that Neptune’s mass and gravitational might have worked to kick Pluto-Charon both into its more excentric orbit and high inclination than that Neptune “captured” Pluto-Charon from the Kuiper Belt. In fact, that Pluto-Charon has an orbital resonance with Neptune of 3:2 would seem to cement this argument, throwing the proclamation of a minority clique of astronomers into the trash heap where it belongs.

## Other Outstanding Characteristics of the Pluto-Charon system

- Pluto-Charon’s other 4 moonlets have orbit periods in synch with the rotation of Pluto and Charon around one another. To observers on any of these mini-moons, Pluto-Charon will resemble the stellar binary “Tatooine” of Star Wars fame.
- Pluto and Charon both present the same face to the other, permanently, dividing both worlds into other-facing and outward-facing hemispheres. The Moon shows the same face to Earth, but not vice versa.
- Comparison of Pluto-Charon with Earth-Moon (the largest “moon” in the solar system’s “first 8” **in comparison with the planet around which it revolves**)

## COMPARITIVE ANGULAR SIZES:

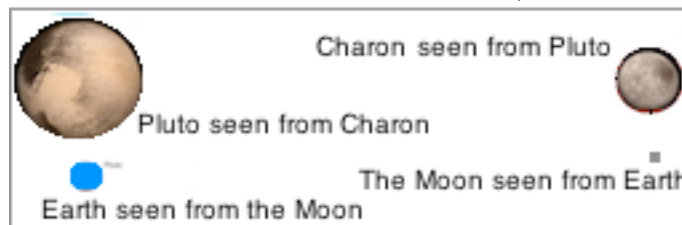
### Earth-Moon

Earth ~2° in diameter as seen from the Moon; The Moon is ~0.5° as seen from Earth

### Pluto-Charon

Pluto ~ 8° in diameter as seen from Charon, 4 times the diameter of Earth seen from the Moon

Charon ~ 4° in diameter as seen from Pluto, 8 times the diameter of the Moon as seen from Earth



## COMPARITIVE MASSES

Earth has 80 times the mass of the Moon

Pluto has only 8.5 times the mass of Charon, clearly a binary planet pair, not just “a planet and moon.”

Pluto and Charon are a closer match than Earth and the Moon, not only in relative size and mass, but in appearance from one another.

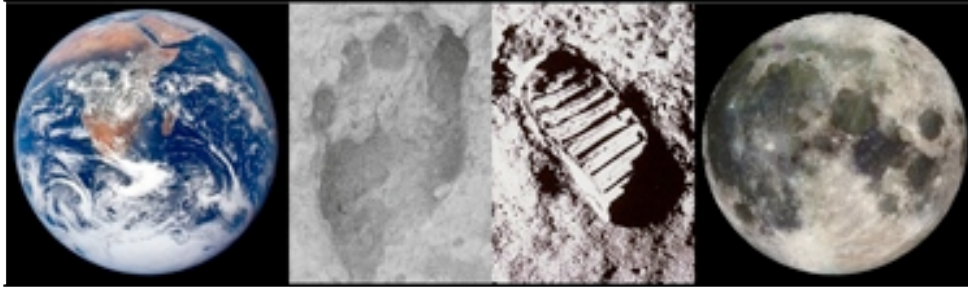
As Pluto and Charon both show the same face to one another, and their distance is constant, a “space elevator” between them is quite feasible – perhaps the most feasible in the solar system.

\* Dynamics of Pluto’s and Neptune’s crossing orbits: <http://www.astronomycafe.net/qadir/q364.html> ##

For past articles, Visit [http://www.moonsociety.org/publications/mmm\\_classics/](http://www.moonsociety.org/publications/mmm_classics/) or /mmm\_themes/



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  
industrializa-  
tion 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](http://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](mailto:president@moonsociety.org)

## From Moon Society President Ken Murphy

While NASA is fixated on Mars, there remains a sizeable cadre of individuals who are looking at the rest of the Solar System as a destination for human exploration. Increasingly, folks are beginning to understand that it is Cislunar Space that should be the focus of our attention in the near future, and that key developments like infrastructure can provide huge leverage to achieve other destinations.

Coming off another successful Moon Day event in Dallas, I have to profess bafflement at the ongoing meme in the space advocacy movement that public interest in space is de minimis, and half-hearted at best. What I saw in our crowd of 1,600 visitors was a deep interest in science and engineering, and in space as a domain to hone those activities and unveil new discoveries. I also saw generations cultivating new generations in the joys of a technological future. It's interesting to note that of our over three dozen exhibitors, it was those exhibitors who had the youngest presenters who were seeing the most interest from our young visitors. Those with older presenters (i.e. Baby Boomers) saw much less traffic, in general. This is interesting because of what it points to in terms of space advocacy.

Throughout human history, our accumulation of knowledge has been critically underpinned by a cultivation of each succeeding generation to carry the increasingly bright torch of human knowledge.

For past articles, Visit [http://www.moonsociety.org/publications/mmm\\_classics/](http://www.moonsociety.org/publications/mmm_classics/) or [mmm\\_themes/](http://www.moonsociety.org/publications/mmm_themes/)

## The Moon Society – Lunar Frontier Settlement – [www.moonsociety.org](http://www.moonsociety.org) p.2

Due to social demographics in most Western philosophy countries, there has been a breaking down of this bridging between generations. This has affected most industries, and space is no exception. The recent fly-by of Pluto is a perfect example, with an average age shown in photos and video of the Mission Control Center that was at least twice what it should have been. Space is still dominated by the generation that can't let go of Apollo, and as a consequence is becoming an industry that year after year is becoming an 'old man's' industry, like insurance. Look at the speaker lists of the major space conferences – dominated by grey hairs. Look at our exploration strategy, which is basically to check off the planetary bucket list within a generation (now complete, if post facto), and MARS!

One of the most valuable roles The Moon Society can play in being a generational bridge to keep passion for the exploration and development of our Moon is to ensure that we are spreading Moon knowledge. It's that simple. There are profound levels of ignorance regarding our Moon, and so people can't see the value in making it a priority for our space efforts. Everyone thinks 'Mars' because NASA says 'Mars', but cislunar space is where we will learn to live and work off-Earth.

I will therefore continue to encourage all of our members to make an effort to do outreach presentations in their local communities. To assist in this effort, I will be uploading two presentations to the TMS website that members can use to make presentations. These will be in powerpoint format as well as pdf. The powerpoint format will allow members to change the presentation to their preferences. Some of the information is quite challenging (by design), but that's how kids learn that there are still areas in the field of space sciences where they can make a name for themselves.

The first presentation will be a Moon 101 presentation, focused on providing almanackal information regarding our Moon, while the second will be my Cislunar Space presentation that I've given to audiences as diverse as an elementary school astronomy club and Mensa. The Cislunar Space presentation is focused on providing context for the Moon as part of a diversity of near-Earth, near-future activities, and is digested from my Cislunar Ecosphere article in The Space Review:

<http://www.thespacereview.com/article/2027/1>

<http://www.thespacereview.com/article/2033/1>

This article has been cited in Le Monde diplomatique, a CENAA White Paper, a recent NASA study 'Germinating the 2050 Cis-Lunar Ecosphere', and the upcoming book 'Space Mining Resources' from the IAA. Both Paul Spudis and Gordon Woodcock have seen the presentation and given it a thumbs up, so you can be assured it's solid. It also blows people's minds when they see a bigger picture of Earth-Moon space that they had never considered.

In addition to making these presentations available, we will also be putting together an 'Outreach Packet' that we will be sending to TMS chapters to use as part of their educational efforts, to include 'Carpe Lunam' and TMS buttons, informational postcards, posters, and other materials to distribute.

There are several upcoming opportunities for members to share their Moon knowledge with their communities.

**International Observe the Moon Night (InOMN) is September 19th, the same as Astronomy Day.**

Details at: [http://www.lpi.usra.edu/observe\\_the\\_moon\\_night/](http://www.lpi.usra.edu/observe_the_moon_night/);

**World Space Week is October 4th – 10th.** Details at: <http://www.worldspaceweek.org/>

If you have a local event already, contact them and offer to help out. If not, make your own. Reach out to other local space clubs and make it a party. It's really a lot of fun! If we don't cultivate the next generations of space-interested individuals, there won't be future generations of space-interested individuals.

We have a unique opportunity with **the upcoming 50th anniversary of Apollo 11 in 2019**. We can use the run-up to that anniversary to promote the idea of humans living and working on our Moon. It's an idea that doesn't get anywhere near enough coverage or publicity, but there's no rule that says we can't force the issue.

**Our membership can become Lunar Ambassadors** to prepare a groundswell of support for a strategic space program that uses our Moon to humanity's benefit. We know these things, but far too many don't. We can be the agents of change. It's all up to you.

If you need pointers on how to proceed, feel free to drop me a line at [president@moonsociety.org](mailto:president@moonsociety.org)

### Two Years to Prepare for ISDC 2017 St. Louis

Hosted jointly by NSS St. Louis and Moon Society St. Louis

An Opportunity for us too shine – with ample prep time

The Milwaukee chapter is considering creating some new exhibits that would be donated to the St. Louis NSS/Moon Society chapters. These are still in the conceptual stage.

For past articles, Visit [http://www.moonsociety.org/publications/mmm\\_classics/](http://www.moonsociety.org/publications/mmm_classics/) or [http://www.moonsociety.org/publications/mmm\\_themes/](http://www.moonsociety.org/publications/mmm_themes/)

## “Pluto Palooza” Parties: Opportunity to Expose Pluto’s Current Misclassification

By Peter Kokh



**Pluto-Charon** (pronounced “chair-on” (not “care-on”)) has turned out to be a very different, very fascinating “binary planet” system, arguably one of the most fascinating in our Solar System.

We have known for years that Pluto-Charon is a binary planet, and have continued to talk about “Pluto” as if Charon were “just a moon.” The difference, religiously noted among stars, has been ignored in the Pluto system to the discredit of the Astronomical Community.

**Terrestrial planets and gas giants** – not to forget “binary planets”

We’ve classified both types (rocky and gaseous) as “planets” despite the enormous difference between them, and declassified Pluto (not even mentioning Charon, to the astronomy community’s discredit) on pettie grounds, choosing to confuse the public, instead of educating them about the amazing variety of planets in our system.

Now that **our Solar System Planetary Zoo is more diverse than we had ever imagined**, we will be able to appreciate even more the vast “variety” of “exo” solar systems discovered by space telescope and other new giant Earth-based telescopes, and new kinds of accessory instruments – it is an exciting time to be alive!

Indeed, we predict that our own solar system is more diverse than even the most up to date of us can imagine. It is more likely than not that the Kuiper Belt object that New Horizons may visit next will turn out to be boring in comparison to Pluto-Charon. And it may be a decade or more before we find other objects in the outer solar system that do not fit present classifications. But we live in exciting times and must be willing to revise our “established” classifications.

### **What Space Societies can do**

- Mount local campaigns to get local observatories and astronomy faculties to readjust their classification systems to include “binary planets.” Letters to these facilities can be published in local news media so that the public knows what we are attempting to do, and add their support.
- Classify publications already in print/circulation on the number and kinds of “official misinformation.”
- Circulate petitions to correct current premature classifications – our universe belongs to all of us, after all, not to just “professional astronomers set in their ways.”
- At the local Pluto Palooza Party – scheduled to the convenience of our individual local chapters, we can brainstorm exhibits, and brochures about Pluto-Charon, and list local astronomy clubs where we can present our updated view of the Solar System, and other opportunities to reach out.
- Media and group connections made for this purpose can be used again for other space topics and promotions.
- Any publicity we get might pay off in other outreach opportunities, requests for speakers
- This activity could lead to a deeper and wider understanding of Earth’s solar neighborhood.
- The public deserves the full truth, not the shabby dismissing half truths put out by a clique.
- We have nothing to lose, a lot to gain.    ##

March

**Chapters & Outposts**

2015

**ORGANIZING “OUTPOSTS”****Bay Area Moon Society, CA Outpost** – South San Francisco Bay – <http://www.moonsociety.org/chapters/bams/>Contact: Henry Cates [hcate2@pacbell.net](mailto:hcate2@pacbell.net) Meeting the 1<sup>st</sup> Tuesday of the Month at Henry's home**Moon Society Nashville Outpost** – Contact: Chuck Schlemm – [cschlemm@comcast.net](mailto:cschlemm@comcast.net)**ORGANIZED CHAPTERS****Milwaukee Lunar Reclamation Society** – <http://www.moonsociety.org/chapters/milwaukee/><http://www.meetup.com/Milwaukee-Space-Exploration-Meetup/> – <http://www.space-Milwaukee.com>Contact: Peter Kokh – [kokhmmm@aol.com](mailto:kokhmmm@aol.com) – MEETINGS, 2nd Saturday 1–4 pm monthly except July, August,

At Mayfair Mall lower level Community room G150 for all meetings except December, in G110:

**Upcoming Meetings: SEP 12, OCT 10, NOV 14, DEC 12****July Report:** On Saturday, July 18, we had a tent at the Bong Recreational Area amateur rocket launching activity.On **Saturday, September 12 1–4 pm at Mayfair Mall, Room G150**, we will host our **Pluto Palooza Party**, with updates on the findings of the New Horizons probe, and more.**Moon Society St./NSS Louis Chapter** – <http://www.moonsociety.org/chapters/stlouis/><http://www.meetup.com/Saint-Louis-Space-Frontier-Meetup/>Contact: Robert Perry [surfer\\_bob@charter.net](mailto:surfer_bob@charter.net) – We meet the **4th Saturday month** in room 162 of McDonnell Hall of Washington Univ., held jointly with the **St. Louis Space Frontier**, a chapter of the National Space Society.Space Trivia Night: Sat. Aug. 8<sup>th</sup>, 7:30 pme 2720 Sutton Boulevard, 2720 Sutton Boulevard, Saint Louis.**EVERYONE LOVES TRIVIA.** by Judy Tippet The St Louis Space Frontier is having their first ever Trivia Night on August 8th at a venue in Maplewood called Focal Point. This evening is a fund raiser to support the Gateway to Space Seminar we are offering on September 26th at Boeing's Prologue Room. Hosted by: [Christine Nobb](#) (**Upcoming meetings: AUG 22 – SEP 26 – OCT 24 – NOV 29 – DEC 28****NSS/Moon Society Phoenix Chapter** – <http://nssphoenix.wordpress.com/> – c/o Mike Mackowski.<http://www.meetup.com/NSSPhoenix/events/161939572/>

Meeting 3rd Saturdays monthly at Humanist Community Center, Mesa, 627 W. Rio Salado Parkway.

**AUG 15 – SEP 19 = OCT 17 – NOV 21 – DEC 19****The June 20, 2015 meeting** of the Phoenix Chapters of the National Space Society and the Moon Society featured Rebeca Rodriguez talking about her experience as a crew member at the Mars Desert Research Station this past winter. Rebeca is an aerospace engineer and started her own STEM education mail-order kit business. We had about 15 attendees, including some new folks who came via MeetUp and some of our other promotional activity. Afterwards about ten of us got together for lunch at a nearby diner. We discussed the latest news in space exploration and considered ideas for future club events, including a possible “Pluto Party” next month.

Submitted by: Mike Mackowski

On **July 14**, we had a **New Horizons Pluto Flyby event** 3:30–7 pm at the Gallery of Scientific Exploration # Marsoth Exploration Theater, featuring presentations by Dr. David Williams # Dr. Steven Desch with a live broadcast feed from NASA TV**Tucson L5 Space Society** – Now serving Moon Society Members [www.tucsonspacesociety.org/](http://www.tucsonspacesociety.org/) (not updated) – [www.meetup.com/NSSPhoenix/events/161939572/](http://www.meetup.com/NSSPhoenix/events/161939572/) (not updated)Contact: Al Anzaldúa – Saturday, 18 July 2015, 10a m–4 pm, Gerard P. Kuiper Space Sciences buildings 1629 E University BLVD, Tucson, We will have a table for NSS outreach to the public, including our new computer for a video loop and the Oculus Rift VR. More information: [www.lpl.arizona.edu/calendar/934](http://www.lpl.arizona.edu/calendar/934)**Clear Lake NSS/Moon Society Chapter (Houston)** – <http://www.moonsociety.org/chapters/houston/>Contact: Eric Bowen [eric@streamlinerschedules.com](mailto:eric@streamlinerschedules.com) – Meeting 7 pm 3<sup>rd</sup> Mondays of even # months in the conference room of the Bay Area Community Center at Clear Lake Park: **AUG 17 – OCT 19 – NOV 21**



**JUNE 2015 SPACE NEWS BROWSTING LINKS****SPACE STATIONS + ROCKETS + COMMERCIAL SPACE**

[www.nasa.gov/press-release/nasa-prepares-for-future-space-exploration-with-international-undersea-crew](http://www.nasa.gov/press-release/nasa-prepares-for-future-space-exploration-with-international-undersea-crew)  
[www.space.com/30104-russia-international-space-station-2024.html](http://www.space.com/30104-russia-international-space-station-2024.html)

**EARTH + NEAR SPACE**

[www.space.com/29588-lightsail-spacecraft-deploys-solar-sail.html](http://www.space.com/29588-lightsail-spacecraft-deploys-solar-sail.html)  
[www.space.com/29620-airbus-adeline-reusable-rocket-space-tug.html](http://www.space.com/29620-airbus-adeline-reusable-rocket-space-tug.html)  
[www.nasa.gov/press-release/nasa-issues-request-for-proposals-for-new-class-of-launch-services/](http://www.nasa.gov/press-release/nasa-issues-request-for-proposals-for-new-class-of-launch-services/)  
[www.space.com/29529-boeing-space-capsule-nasa-commercial-crew.html](http://www.space.com/29529-boeing-space-capsule-nasa-commercial-crew.html)

**MOON**

[www.space-travel.com/reports/Crashing\\_comets\\_may\\_explain\\_mysterious\\_lunar\\_swirls\\_999.html](http://www.space-travel.com/reports/Crashing_comets_may_explain_mysterious_lunar_swirls_999.html)  
[www.space-travel.com/reports/Russia\\_to\\_Land\\_Space\\_Vessel\\_on\\_Moons\\_Polar\\_Region\\_in\\_2019\\_999.html](http://www.space-travel.com/reports/Russia_to_Land_Space_Vessel_on_Moons_Polar_Region_in_2019_999.html)

**MARS**

[www.nasa.gov/press-release/nasas-ldsd-project-completes-second-experimental-test-flight](http://www.nasa.gov/press-release/nasas-ldsd-project-completes-second-experimental-test-flight)  
[www.nasa.gov/press-release/nasa-spacecraft-detects-impact-glass-on-surface-of-mars](http://www.nasa.gov/press-release/nasa-spacecraft-detects-impact-glass-on-surface-of-mars)  
[www.space.com/29756-impact-glass-preserve-mars-life.html](http://www.space.com/29756-impact-glass-preserve-mars-life.html)  
[www.space.com/29759-earth-mars-share-seeds-of-life.html](http://www.space.com/29759-earth-mars-share-seeds-of-life.html)  
[www.space.com/29674-mars-meteorites-methane-life-search.html](http://www.space.com/29674-mars-meteorites-methane-life-search.html)  
[www.space.com/29769-spacesuit-technology-mars-exploration.html](http://www.space.com/29769-spacesuit-technology-mars-exploration.html)  
[www.space.com/29766-mars-astronauts-landing-sites-nasa-workshop.html](http://www.space.com/29766-mars-astronauts-landing-sites-nasa-workshop.html)  
[www.space.com/29540-manned-mars-mission-propulsion-technologies.html](http://www.space.com/29540-manned-mars-mission-propulsion-technologies.html)

**ASTEROIDS + COMETS**

[www.space.com/29603-dwarf-planet-ceres-video-nasa-dawn.html](http://www.space.com/29603-dwarf-planet-ceres-video-nasa-dawn.html)  
<http://www.jpl.nasa.gov/news/news.php?feature=4633>  
[www.space.com/29541-eerie-comet-landscape-photos.html](http://www.space.com/29541-eerie-comet-landscape-photos.html)  
[www.esa.int/Our\\_Activities/Space\\_Science/Rosetta/Ultraviolet\\_study\\_reveals\\_surprises\\_in\\_comet\\_coma](http://www.esa.int/Our_Activities/Space_Science/Rosetta/Ultraviolet_study_reveals_surprises_in_comet_coma)  
[www.esa.int/Our\\_Activities/Space\\_Science/Rosetta/Rosetta\\_s\\_lander\\_Philae\\_wakes\\_up\\_from\\_hibernation](http://www.esa.int/Our_Activities/Space_Science/Rosetta/Rosetta_s_lander_Philae_wakes_up_from_hibernation)  
[www.esa.int/Our\\_Activities/Space\\_Science/Rosetta/Rosetta\\_mission\\_extended](http://www.esa.int/Our_Activities/Space_Science/Rosetta/Rosetta_mission_extended)  
[www.space.com/29672-rosetta-comet-eruptions-surprising-discovery.html](http://www.space.com/29672-rosetta-comet-eruptions-surprising-discovery.html)

**OTHER PLANETS + MOONS**

[www.space.com/29340-mercury-ancient-magnetic-field.html](http://www.space.com/29340-mercury-ancient-magnetic-field.html)  
[www.esa.int/spaceinimages/Images/2015/06/Messenger\\_s\\_iridescent\\_Mercury](http://www.esa.int/spaceinimages/Images/2015/06/Messenger_s_iridescent_Mercury)  
[www.space.com/29742-venus-volcanoes-still-active.html](http://www.space.com/29742-venus-volcanoes-still-active.html)  
[www.space.com/29604-nasa-jupiter-moon-europa-surface-mission.html](http://www.space.com/29604-nasa-jupiter-moon-europa-surface-mission.html)  
[www.space.com/29644-cryobot-tunneling-robot-explore-icy-moons.html](http://www.space.com/29644-cryobot-tunneling-robot-explore-icy-moons.html)  
[www.space.com/29713-europa-mission-approved-for-development.html](http://www.space.com/29713-europa-mission-approved-for-development.html)  
[www.esa.int/Our\\_Activities/Space\\_Science/Dissolving\\_Titan](http://www.esa.int/Our_Activities/Space_Science/Dissolving_Titan)

**ASTRONOMY + ASTROBIOTICS**

[www.space.com/29729-thirty-meter-telescope-construction-restart.html](http://www.space.com/29729-thirty-meter-telescope-construction-restart.html)  
[news.sciencemag.org/funding/2015/06/giant-magellan-telescope-gets-green-light-construction](http://news.sciencemag.org/funding/2015/06/giant-magellan-telescope-gets-green-light-construction)  
[www.space.com/29677-floating-cloud-space-telescope-glitter-tech.html](http://www.space.com/29677-floating-cloud-space-telescope-glitter-tech.html)  
[www.space.com/29684-search-for-alien-life-science-technology.html](http://www.space.com/29684-search-for-alien-life-science-technology.html)  
[www.space.com/29683-why-arent-aliens-calling-earth.html](http://www.space.com/29683-why-arent-aliens-calling-earth.html)  
[www.space.com/29752-cometlike-planet-first-of-its-kind.html](http://www.space.com/29752-cometlike-planet-first-of-its-kind.html)

**EDUCATION + OUTREACH + MEDIA**

[www.space.com/29657-nasa-sample-return-robot-challenge-2015.html](http://www.space.com/29657-nasa-sample-return-robot-challenge-2015.html)  
[www.nasa.gov/press-release/nasa-awards-100000-to-winning-team-of-robot-challenge](http://www.nasa.gov/press-release/nasa-awards-100000-to-winning-team-of-robot-challenge)  
[www.space.com/29630-high-school-student-discovers-exoplanet.html](http://www.space.com/29630-high-school-student-discovers-exoplanet.html)  
[www.space.com/29714-grand-canyon-star-party.html](http://www.space.com/29714-grand-canyon-star-party.html)  
[www.space.com/29710-milky-way-trails-over-grand-canyon-star-party-in-time-lapse-video.html](http://www.space.com/29710-milky-way-trails-over-grand-canyon-star-party-in-time-lapse-video.html)  
[www.space.com/29778-student-experiments-nasa-suborbital-rocket.html](http://www.space.com/29778-student-experiments-nasa-suborbital-rocket.html)

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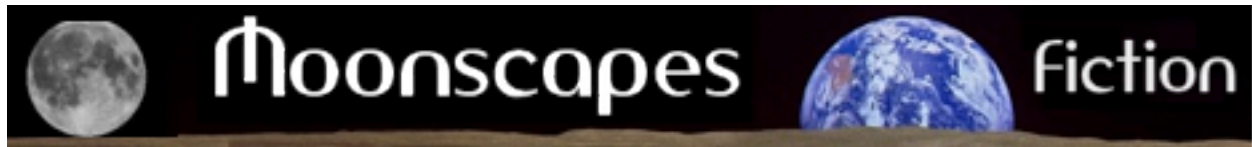
## JULY 2015 SPACE NEWS BROWSING LINKS

### PLUTO-CHARON BINARY PLANET SYSTEM

<https://solarsystem.nasa.gov/planets/plutotoolkit.cfm>  
[www.space.com/29872-names-pluto-map-new-horizons.html](http://www.space.com/29872-names-pluto-map-new-horizons.html)  
[www.space.com/29850-new-horizons-pluto-flyby-complete-coverage.html](http://www.space.com/29850-new-horizons-pluto-flyby-complete-coverage.html)  
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**Wow!!!**

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### Simon Sidekick (cont. Part 6, Conclusion) By John E. Stith

MISSED THE PREVIOUS INSTALLMENTS? <http://www.moonsociety.org/publications/fiction/SS-JES.pdf>

Carl was just turning around to go back to the ladder when he saw the shadow. Ten meters away, the jagged edge of the rim's shadow stretched across the crater floor. But now there was a prominence in the shadow that wasn't there before.

It resembled a suited figure.

Carl turned to face the rim, and looked up. There was someone at the rim.

"It has to be Peter," he said. "But why? Is he going to take the ladder up? Or is he going to help? Or stand there and gloat?"

"I believe you are asking the wrong person."

He stood there watching for a long moment, almost afraid to find out why the other was here. Finally, with a catch in his throat, he switched on suit communications.

"Is that you, Peter?"

"Yes." He didn't add anything more. This wasn't easy.

"Did you come to help?" He didn't know if the dread sounded in his voice.

"Do you want me to?"

Carl didn't say anything for a moment. "Yes," he finally replied. It was one of the hardest things he ever did.

"OK. I'm coming down."

Neither spoke until they both stood near the box.

"I don't mean to be ungrateful," Carl started hesitantly. "But why are you here? You've played tricks on me before, and I haven't made it very easy on you lately. Is this your good deed for the day?"

"Not exactly. You're--you're kind of a challenge, I guess you'd say. I see my dad getting along with people he really dislikes. You're not nearly so annoying as some of the people in Jane Doe politics, but I could never reach you. What I mean--"

"I know. I think I understand. And--and thanks for coming out here. I didn't realize that part of the search was to promote the buddy system."

"I think the adults would have found a way to lock up the suits and have emergency overrides, if they didn't see any value in this. Like my dad says, Jane Doe Station is the frontier right now."

Carl wished Peter wouldn't talk so much about his father, but he didn't say anything.

"Are you ready?" Carl asked.

"Let's do it."

Peter had suggestions on how to get it done quickly, so Carl listened. Soon, he was bounding toward the second transmitter, his suit communications switched off long enough to say, "Thanks, Simon."

"For what?"

"You know very well what." He switched the suit radio back on.

It wasn't long before they were both ready for the new sightings. Carl activated the switch labeled 'B', and they marked the headings. They started on their separate courses. About twenty minutes later they met again.

A spiral search in the dust yielded the plastic disk in less than five minutes.

Almost too quickly, it was over and they were on the way back. Carl was quiet as they walked, thinking. At last he said, "Peter, I'll explain later, but I'd like to turn off my suit radio for just a few minutes. OK?"

"Fine."

"Are you all right?" Simon asked after Carl had been silent for a long moment.

"Yes and no," he replied slowly.

"Can you be more specific?"

"I mean I've been doing a lot of thinking recently."

"And?"

"And I've realized a few things about the two of us."

"Go on."

"Pel never actually planned on my keeping you, did he?"

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This time, Simon's voice came slowly too. "No," he said with what sounded almost like sadness. "No, I am afraid not."

"Simon, I feel so helpless. There's no way I can ever repay you for the things you've shown me. What could any human do for you?"

"What have I shown you?"

"You know. That Peter just wanted me to accept him--that maybe he wants to be a leader like his father. That perhaps I need people more than I thought."

"I did not show you those. You found them."

"You know perfectly well what I mean."

As the two boys reached the top of the next rise, the station's antennae and solar panels glinted in the sun. They came closer and Carl could see that near the airlock, squeezed against the window, was a large crowd of kids. Even from here they looked excited. Carl held the disk away from his body so they could see it.

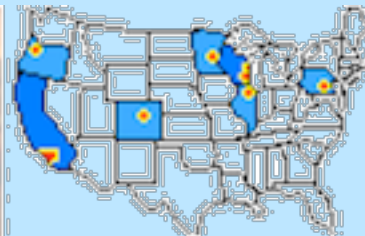
"Simon," he said fiercely, his vision blurring momentarily. "I don't care how soon Pel expects you back. I want at least another week."

END

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Phone: (719) 5980365

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## NSS Chapters that share Moon Miners' Manifesto



Space Chapter HUB Website: <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.moonsociety.org/chapters/milwaukee/](http://www.moonsociety.org/chapters/milwaukee/)  
[www.Space-Milwaukee.com](http://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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372-9613 – [bobriverwest@yahoo.com](mailto:bobriverwest@yahoo.com) (• Current Members of the MLRS Board of Directors)

On Saturday, July 18, we had a tent at the Bong Recreational Area amateur rocket launching activity.  
On Saturday, September 12 1-4 pm at Mayfair Mall, Room G150, we will host our **Pluto Palooza Party**, with updates on the findings of the New Horizons probe, and more.

**Our 2015 Meeting Schedule:** We switch to room G150 for all meetings except December, in G110:  
SEP 12, OCT 10, NOV 14, DEC 12

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**SSS – Sheboygan Space Society****728 Center St. Kiel, WI 54042–1034**[www.sheboyganspacesociety.org](http://www.sheboyganspacesociety.org) c/o Will Foerster 920–894–1344 (h) [astrowill@frontier.com](mailto:astrowill@frontier.com)SSS Sec./Tres. c/o B.Pat Knier [dcnpatknier@gmail.org](mailto:dcnpatknier@gmail.org)

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

Meetings are at The Stoelting House, 309 Indian Hill, Kiel WI 53042 – **3rd Thurs even # months****2015 MEETINGS:** AUG 20 – OCT 15 – DEC 12 (2<sup>nd</sup> SAT in Milwaukee)

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 [odyssey\\_editor@yahoo.com](mailto:odyssey_editor@yahoo.com)[oasis@oasis-nss.org](mailto:oasis@oasis-nss.org) – Odyssey Newsletter [www.oasis-nss.org/articles.html](http://www.oasis-nss.org/articles.html)**Regular Meeting 3 pm 3<sup>rd</sup> SAT monthly – 2015 SCHEDULE;** AUG 15, SEP 19, OCT 17, NOV 21, DEC 19

OASIS held a potluck picnic, Sat., July 18, 12:30 pm, at Polliwog Park, Manhattan Beach Blvd

COLORADO

**DSS: Denver Space Society fka Front Range L5****1 Cherry Hills Farm Drive, Englewood, CO 80133**<http://www.denverspacesociety.blogspot.com/>Eric Boethin 303–781–0800 [eric@boethin.com](mailto:eric@boethin.com) – Monthly Meetings every 3rd Thursdays, 7 pm

Englewood Public Library, Englewood, CO 80110 – 1000 Englewood Parkway, First Floor Civic Center

**2015 MEETINGS:** Aug 20, Sept 17, Oct. 15, Nov. 19, Dec. 17

ILLINOIS

[LDAhean@aol.com](mailto: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** 7–9 pm on the first Thursday of each month at the Fairview Community Center (Great Room), 1910 County Road B West, in Roseville, MN 55113 Each meeting features Board member introductions, general announcements. On Tuesday, June 30<sup>th</sup>, we participated in the global awareness program for the first annual Asteroid Day at Moscow on the Hill, 371 Selby Ave. St Paul, MN 55102, starting 7 pm.

OREGON

**Oregon L5 Society – <http://www.OregonL5.org>****PO Box 86, Oregon City, OR 97045**(LBRT – Oregon Moonbase) [moonbase@comcast.net](mailto:moonbase@comcast.net) – No information available.For past articles, Visit [http://www.moonsociety.org/publications/mmm\\_classics/](http://www.moonsociety.org/publications/mmm_classics/) or [mmm\\_themes/](http://www.mmm_themes/)

PENNSYLVANIA



**NSS-PASA: NSS Philadelphia Area Space Alliance**  
**928 Clinton Street, Philadelphia, PA, 19107**

c/o Earl Bennett, [Earlisat@verizon.net](mailto:Earlisat@verizon.net) – 856/261-8032 (h), 215/698-2600 (w)

<http://pasa01.tripod.com/> - <http://phillypasa.blogspot.com>

### The NSSPASA Report for July, 2015

**Meeting Locations and times:** Our regular meeting will be on August 8 at the Liberty One Food Court from 1 to 3 p.m.. I have not received a report from Mitch on his outreach event during the July/August period.

**Pluto Flyby:** we did not have an event on the actual night of the flyby and have not received a confirmation on an event at the Franklin Institute. We may still have an event, but, it will not be on the fun public event part of the mission, where people were having a great time at 9 p.m. getting the word that the craft had successfully completed close approach and was not damaged or destroyed during the encounter, but were anticipating “early results” to be available in the Fall. The data is coming down slowly (not due to malfunction just distance and power available) and will not be completed till late next year. The early results should be available before Philcon and, if there is an early results event at the Franklin, we may be able to have scientific results, and probably more pictures with analysis, for that event. Back to our meeting...

We had a guest at our July meeting: Nate Henderson. He recently graduated from Villanova University and is hoping to work in the aerospace field in the financial aspect of the overall business. He is hoping to work for one of several leading organizations to learn the art of space business finance. He was very knowledgeable and contributed to a number of our conversation threads. Welcome, Nate!

Larry gave our report on the website and the continuing improvement of our visibility thanks to his relocation of our content to the NSS Chapters part of the NSS website. He has given us a new web presence at: <http://chapters.nss.org/pa/philadelphia>. And the tripod photos have been transferred too. They are in our Google Blog. There were several questions on our blog and blogging. Larry also brought material on sun spot activity (trending down) and the GOES-R(O) satellite for weather sensing. This craft, whose many instruments are used for weather imaging in the visible and infra-red wavelengths, also contains a new system, by PlanetiQ, is called The Pyxis. It examines the effect of the various layers of the atmosphere and ionosphere on G.P.S. signals that it picks up as they travel through these layers just like the technique used for planetary atmospheric study when our probes are passing behind, or emerging from behind, the various planets and moons we send vehicles to. Planet Q's plan is to put a fleet of micro satellites (12 initially) into Earth orbit in the 2016-2017 period. They will deliver more than 8 million measurements a day. Supplemental material is from the July Microwaves and RF for July 2015.

Dorothy brought information on something that is getting more and more common in our lives: education on how to use 3D printers for your own creations. She cited The Franklin Institute's monthly classes on how to do this. The next courses are: August 26, and, September 19. These classes are in addition to the regular events at the Institute including: Journey to Space, an ongoing movie, which includes the NASA Roadmap to Space (narrated by Patrick Stewart) in IMAX format, and, several films in the Planetarium. For more see the Franklin site or google it.

Mitch was away, but, there is more from the summer Ad Astra: on page 44 the NSS has a Space Settlement column, by Dave Dunlop and Fred Becker, entitled: Why an International Lunar Decade Campaign for Science, Exploration, and Development Can Make a Difference. There is a nice chart on upcoming activity planned for the Moon from the X-Prize groups to the Chinese plans and the NASA Moon related operations. There is more especially discussion of the 2013 “The Global Exploration Roadmap. The idea is to create a multinational event similar to the International Geophysical Year of 1958. This was great for science and getting it into everyone's consciousness at the time and it may do the same now for The Lunar Enterprise overall. See the report and the NSS site.

Hank Smith told us that the Philcon Committee has selected a Principal Speaker. The other guests have not been selected yet and he had no updated flyers. He did announce plans to continue his personal outreach campaign for us and the Philcon in the Fall. This was partly for Nate Henderson's benefit as he has never been to a science fiction convention here.

Dennis Pearson reported that he is not Regional Coordinator for multiple chapters now. Right now there are very few NSS chapters in our region. We have a new chapter forming in Northern New Jersey: Carl Hricka is putting together a chapter in northwestern N.J.. He has an unusual advantage: he has a weekly radio show for 20 minutes where he gets to interview people on space and his favorite subject, astronomy. Great! Dennis also told us that the

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Chapters Committee is distinct from the main NSS organization. Dennis also mentioned the Pluto videos and an editorial from the New York Times: “The End of the Planetary Exploration Age”. Since we have explored the last planet in our solar system we will now be moving into the age of exploitation and colonization. This started an extended conversation that included Nate on the opportunities in asteroid mining and mining the Moon. We introduced him to Gerrard K. O’Neills work and the founding of L-5 (one of the groups that created the N.S.S.).

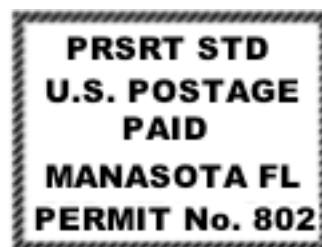
We also introduced Nate to Rich Bowers, who founded our chapter in the mid 1970s. Since Rich loves the idea of the Cycler Space Trolley System (one way of looking at the cycler looping interplanetary transport network) this was discussed as well. Nate was familiar with the concept from his own research. We had several side conversations that included the use of 3D printers to create organs (and some of the details that have to be addressed to make them practical) and the use of advanced printers as part of the future Mars exploration and habitation activities. There was also talk of helping Dennis in September at an event in the Reading area.

Earl continued to bring more material on various subjects including some of the Pluto Flyby material noted above and a recent Wired article on the path to Pluto” The Road to Pluto” A Look Back at New Horizons. This short article includes how it started with planetary scientist Alan Stern pushing the project and making the flyby happen. He started working on this in 1989. That’s persistence! The probe is pictured, on page 22 and 23, on the shake table and really moving. The caption says it is shaking at 60 times a minute. “Rocket Science”. July 2015 issue. The June 27 issue of Science News has lead-up information on the Pluto/Charon Binary Planet system and its’ multiple companion moons ( that is speculated as having been created by a collision between larger objects earlier in the solar systems history). Much more material is now (as of 7/20/15) available from NASA and a number of other sites. We did not have a Pluto event ourselves, but, I was told that some other groups ( not NSS chapters in this case) did have events for the flyby. Remember: the Flyby was not the end of the mission. The Kuiper Belt is along the projected flight path and NASA hopes for more science from the first purpose built probe that can send it back from those distances. There is a huge amount of material as usual but: from NASA Tech Briefs for July: “Create a 3D Printed Habitat for Space” which is being done by a partnership between NASA and The National Additive Manufacturing Innovation Institute, also known as America Makes, who are holding a \$2.25 million dollar competition to design and build a 3D printed habitat for deep space exploration (including the Mars mission). I word the last statement as I have due to the wording in the short report, on page 8, that I see. However that may be: the contest is happening now and prizes will be awarded at the 2015 World Makers Faire in New York, in September. I’m going!

**AMSAT Journal:** a report on a number of satellites being launched by the U.S. Naval Academy. These were student developed satellites, launched in May and included amateur communication capability with two, PSAT and BRICSat-P (W3ADO-6), accepting signals from 10 meter (wavelength) stations rather than the more common 2 meter wavelength band. The modes of communication for all of them is digital using the PSK31 protocol, or, 9600 baud telemetry AX.25 packet format. The third satellite, the USS Langley had not been heard at time of publication of the May/June issue of the Journal. By Bob Bruninga, WB4APR. He can be contacted at the Academy for more at: [bruninga@usna.edu](mailto:bruninga@usna.edu). There is also a travelogue “Fox-1A on the Road to Vandenberg” showing the path that was taken from conception to upcoming launch. Also noted: from “The Apogee View” column by President Barry Baines the possibility of a “rideshare” opportunity for a ham communications system to reach geosynchronous orbit as part of a larger system. This would allow support of emergency communications, a justification for this opportunity, and the location will make 24/7 operation available during disaster conditions. Note: one of the justifications of the allocation of frequencies to amateur radio is this public service activity as well as to create a pool of competent technical people who can improve communications technology and more. Money is being raised for this.

And lastly, from NASA’s Medical Design Briefs comes three interesting pieces: The editorial, by Beth G. Sisk, is called “3D Bioprinting & Socks”. It relates how Ms. Sisk’s sister died of liver disease and how this organ is rarely transplanted, and, how difficult it will be to “print”. She then goes on to the brighter prospects of some things being worked on at present including “printing” blood vessels and skin. Skin? Yes. L’Oreal, the cosmetics giant, has contracted Organovo to produce this material for cosmetics product testing. And much more on page 6. In the back of the magazine (page 43) is a small ad for Stratasys. The ad is for the publication Innovate from the company with a great attention grabber for the ad “3D Printed Synthetic Bone. The brief description is about building skeletal support elements. I have thought of another application (although it may be “out there” at present): production of donor specific blood. And lastly: on page 35 is “Inkjet-Printed Metal for Soft Robotics” from Purdue University. The report is on the researchers solving the problem of stretchable and deformable metal contacts that can be printed on a variety of surfaces with skin being a possible location. See the Purdue website: [www.purdue.edu](http://www.purdue.edu). – Earl Bennett, President, NSPASA, KD2CYA

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