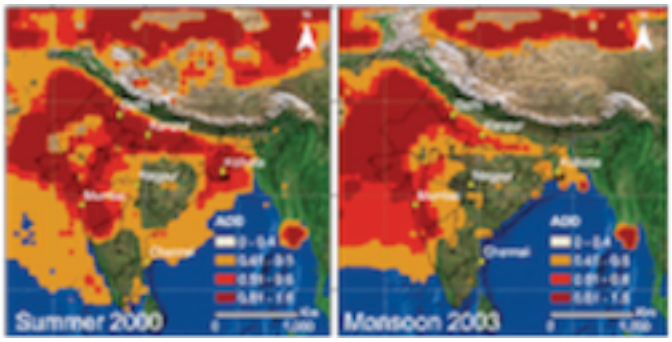
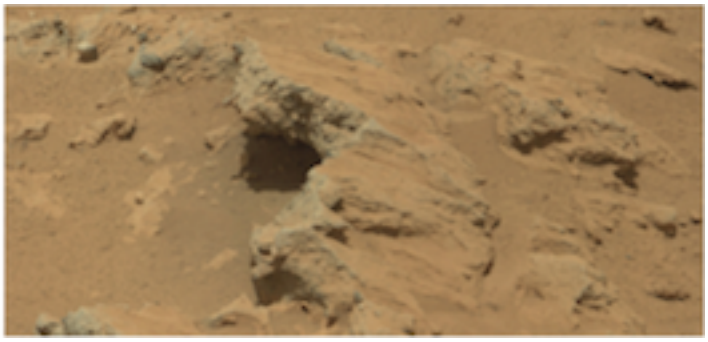
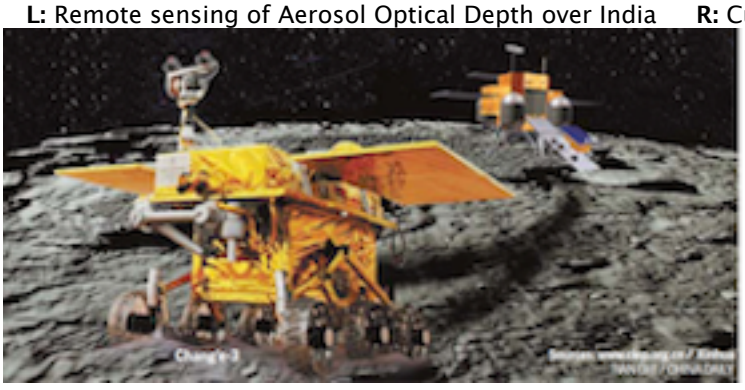
Introducing a new free quarterly newsletter for space-interested and space-enthused people around the globe
This free publication is especially dedicated to students and teachers interested in space



L: Remote sensing of Aerosol Optical Depth over India



R: Curiosity finds rocks shaped by running water on Mars!



L: China hopes to put lander on the Moon in 2013

R: First Square Kilometer Array telescopes online in Australia!

TTSIQ Sponsor Organizations

About The National Space Society – http://www.nss.org/

The National Space Society was formed in March, 1987 by the merger of the former L5 Society and National Space institute. NSS has an extensive chapter network in the United States and a number of international chapters in Europe, Asia, and Australia. NSS hosts the annual International Space Development Conference in May each year at varying locations. NSS publishes **Ad Astra** magazine quarterly. NSS actively tries to influence US Space Policy.

About The Moon Society – http://www.moonsociety.org

The Moon Society was formed in 2000 and seeks to inspire and involve people everywhere in exploration of the Moon with the establishment of civilian settlements, using local resources through private enterprise both to support themselves and to help alleviate Earth's stubborn energy and environmental problems. The Society has a network of chapters in the US and has been an affiliate of NSS since 2005.

About Moon Miners' Manifesto – http://www.moonsociety.org/chapters/milwaukee/mmm/

MMM, has been published 10 times a year since issue #1 December 1986 by the Milwaukee Lunar Reclamation Society chapter of the **National Space Society**. It has also served **the Moon Society** and its predecessor, Artemis Society International, since October 1995.

Most issues deal with the **opening of the Lunar frontier**, suggesting how pioneers can make best use of **local resources** and learn to **make themselves at home.** This will involve psychological, social, and physiological adjustment**.** Much of what will hold for the **Moon**, will also hold true for **Mars** and for space in general. There is one Mars theme issue each year, and occasionally **other space destinations** are discussed: the asteroids, Europa (Jupiter), Titan (Saturn), even the cloud tops of Venus, and interstellar destinations beyond.

About Space Renaissance Initiative – http://www.spacerenaissance.org/

SRI's focus is on use of space resources to address the challenges of runaway population growth and increasing use of Earth resources at a non-sustainable pace. "The settlement of space would benefit all of humanity by opening a new frontier, energizing our society, providing room and resources for the growth of the human race without despoiling Earth, and creating a lifeboat for humanity that could survive even a planet-wide catastrophe."

About The Mars Foundation – http://marsfoundation.org/ – http://marshome.org/

The Foundation seeks to involved interested persons in the design of Mars outposts and settlements, maximizing use of building materials that can be produced on Mars, to illustrate the near-term feasibility of establishing a permanent human presence on Mars.

About Open Luna Foundation – http://openluna.org/missions

The OpenLuna Foundation aims to return to the moon through private enterprise. A stepped program of robotic missions, then short series of manned missions to construct a small, approximately 8 person outpost .

About SEDS: Students for the Exploration and Development of Space – http://www.seds.org/

SEDS is an independent, student-based organization which promotes the exploration and development of space by educating people about the benefits of space, through a network of interested students, providing an opportunity

INDIA – ISRO launches historic "100th Mission" – 2 commercial payloads on board

http://www.hindustantimes.com/India-news/AndhraPradesh/**ISRO-scores-on-100th-mission-PSLV-rocket-launch-successful**/Article1-926906.aspx

September 9, 2012 **Bangalore:** ISRO successfully launched its 100th mission with the commercial launch of two foreign satellites from the spaceport of Sriharikota in Andhra Pradesh.

- The 720-kg SPOT-6 remote sensing satellite from France (built by ASTRIUM SAS)
- The 15-kg Japanese spacecraft Protieres. PROITERES is a landmark mission. It stands for Project of Electric-Rocket-Engine onboard Small Space Ship (PROITERES). If you're interested in the satellite specs, this is what the Earth2Orbit website offers – http://earth2orbit.com/portfolio/portfolio.html
- Osaka Institute of Technology built Protieres, and the Institute is Susmita Mohanty's company Earth2Orbit first customer, facilitating the launch via ISRO.

A recent press article in July, 2012 – http://www.indianexpress.com/news/isro-mulling-hiving-off-satellite-production-to-industry/966138/ notes that ISRO is capitalizing on the commercial space satellite industry, both satellites mentioned above, being commercial efforts.

Both were on board India's Polar Satellite Launch Vehicle (PSLV-C21.)

ISROs 3400-kg communication satellite GSAT-10 was also successfully launched between September 29 by European space consortium Arianespace Ariane-5 rocket from Kourou in French Guiana.
http://zeenews.india.com/news/space/**indias-heaviest-satellite-gsat-10-launched-successfully**_802598.html

INDIA – Bangalore lab to develop Space Suit for ISRO Vyomanauts

http://www.asianscientist.com/in-the-lab/isro-debel-lab-design-space-suit-2012/
http://www.indiandefence.com/forums/indian-strategic-forces/14799-bangalore-lab-suit-up-indian-vyomanauts.html

[**vyomanaut**: an Indian astronaut – from Sanskrit (vyoma, "sky") + -naut]

July 30, 2012 ISRO hopes to launch its first Manned Space Capsule in 2016. But the capsule hardware is only part of the development effort. Indian astronauts will need "Space Suits."

Rather than buy or adapt any suit used by the American, Russian, or Chinese space agencies, ISRO wants to develop its own "indigenous" space suit. To date, each spacefaring nation has developed its own suit(s) and not shared the technologies involved. It is fitting that India follow suite and develop its own suits.

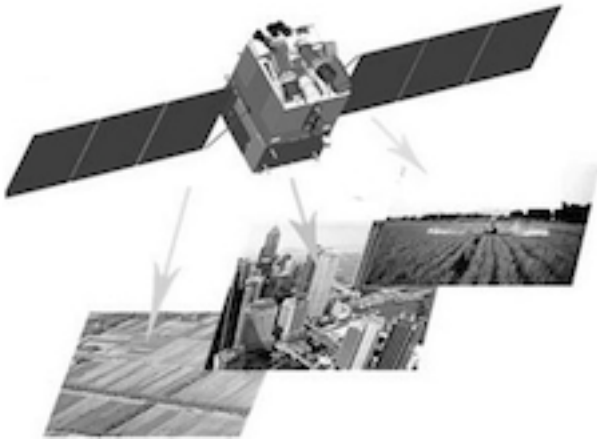
http://en.wikipedia.org/wiki/Space_suit

- Suits must hold pressure, keep the person inside comfortable through a range of temperatures outside.
- They must be designed to allow easy movement and function of the arms and legs.
- The helmet alone will be a major design and engineering project.

"(ISRO) has entered into an agreement with the Bangalore-based Defense Bioengineering and Electromedical Laboratory (DEBEL), which focuses on research and development in the area of aeromedical equipment, human engineering related to aviation, biomedical engineering, and life support system for the armed forces." DEBEL "is part of the state-owned Defense Research and Development Organization (DRDO). >>>

CHINA – **Ziyuan III, China's 1st high-resolution, remote-sensing civilian satellite, begins service**

http://www.chinadaily.com.cn/china/2012-07/31/content_15633168.htm



Launched on Jan 9, the satellite has now been turned over to the National Administration of Surveying, Mapping and Geoinformation. "Ziyuan" is Chinese for "resources." Unlike its predecessors, Zihuan=3 can produce three-dimensional imagery with the three cameras attached to it at different angles.

Other improvements:

- The images' resolution is 2.1 meters, an improvement over 3 meters.
- Its multispectral camera designed to look for mineral resources, has a resolution of 6 meters,
- Ir transmit data at a speed four to five times of previous satellites.
- Its life expectancy is 5 years, up from 3 >>>

Late-breaking – **China launches Earth-Observing Satellite for Venezuela**

http://www.space.com/17849-**china-satellite-launch-venezuela**.html

China seeks to Cooperate Globally on Chinese Space Station

Visitors to China exhibition look at a model of **Tiangong-1** space station. Photograph: Ranwen/Imagine China

http://www.asianscientist.com/topnews/china-cooperate-globally-to-build-chinese-space-station-2020/

Read the full report by TTSIQ co-editor Srinivas Laxman (link above).

Cheng Jingye, China's permanent representative to the UN made this announcement, while addressing the 55th session of the UN Committee On The Peaceful Uses of Outer Space at Vienna on June 6, 2012. Station construction is tentatively scheduled to begin in seeks. That is about the time when the current ISS may be dismantled and de-orbited, though pressures are building, especially among the ISS partners (other than US-NASA) to extend the station's lifetime for several more years.

According to Cheng, this program will prove beneficial to different **countries**, particularly those **that do not have space capabilities**. While the main partners in the US led International Space Station have space transportation capability, several other nations have participated both by contributing equipment and experiments and through their own astronauts, trained either by NASA or Roscosmos.

Germany is the first nation to show interest in the proposed Chinese "I"SS.

In South America, China already collaborates with **Peru**, **Bolivia**, and **Brazil**, and has already had feelers from **Argentina**.

In Asia, China collaborates with **Iran**, **Mongolia**, **Thailand**, **Bangladesh**, and **Pakistan**, and has had collaboration feelers from **Malaysia**, the **Philippines**, and **Sri Lankha**.

[While ISS partners **Russia, Canada, Japan, and ESA** are ready to welcome China to participate in the existing ISS, US legislation prohibits that. The US political climate is not yet favorable to a reconsideration. Both major parties seem to support the present policy, and that is shortsighted and discouraging. PK]

http://nasawatch.com/archives/2012/03/china-as-a-new.html >>>

JAPAN – SPIE Asia-Pacific Remote Sensing 2012 Symposium, Kyoto, Japan, 29 October – 1 November, 2012.

The Symposium will focus on recent research in:

- Remote sensing of the atmosphere, clouds, and precipitation
- Land surface remote sensing
- Remote sensing of the ocean environment
- Lidar remote sensing for environmental monitoring
- Multispectral, hyperspectral, and ultraspectral remote sensing technology, techniques and applications
- Earth-observing missions and sensors: development, implementation, and characterization
- Remote sensing and modeling of the atmosphere, oceans and interactions\

Symposium Chairs are **Upendra Singh,** NASA Langley Research Center. and **Toshio Iguchi,** National Institute of Information and Communications Technology (Japan)

Sponsors, in addition to JAXA and NASA, include ISRO

Location: Kyoto International Conference Center

SPIE is an international society advancing an interdisciplinary approach to the science and application of light, through interdisciplinary information exchange, continuing education, publications, patent precedent, and career and professional growth. >>>

Russia Prepares to Launch second Remote Sensing Satellite

http://www.interfax.com/newsinf.asp?y=2012&m=8&d=3&pg=7&id=352044

Roscosmos plans to orbit its second Remote Sensing satellite, Resurs-P environmental satellite N2 on October 25, 2012, on a Soyuz-2.1b carrier rocket. The **Resurs-P** series of Russian Earth observation satellites will be the successors of the Resurs-DK 1 satellite. This satellite will transmits data via a high-speed radio link to Russian ground stations. The status of natural resources, natural disasters, sea ice conditions and polar weather are available within a few hours to national and international organisations, as well as to private commercial customers. >>>

Russia tests "Quick Trip" to ISS

http://spectrum.ieee.org/aerospace/space-flight/russia-tests-quick-trip-to-space-station – article by James Oberg

"What traditionally has been a two-day trip is now compressed to just 6 hours—but it might complicate international cooperation" – The complexity of the "**fast rendezvous scheme"** and of its options is such that the M3IQ editor would risk significant errors in any attempt to post a "synopsis." If Orbital Mechanics interests you, do read the article by James Oberg in the link given above. >>>

Russian launch of Indonesian Satellite fails

http://www.space.com/16969-russian-proton-rocket-launch-failure.html

http://www.RussianSpaceWeb.com/

Aug. 6, 2012 A pair of communications satellites was left in a wrong orbit by a launch from Baikonur spaceport in Kazakhstan that went wrong. The vehicle carried a 1,903-kilogram **Telkom-3** for Indonesian company PT Telekomunikasi Indonesia Tbk and a 1,140-kilogram Russian **Ekspress-MD2** communications satellites.

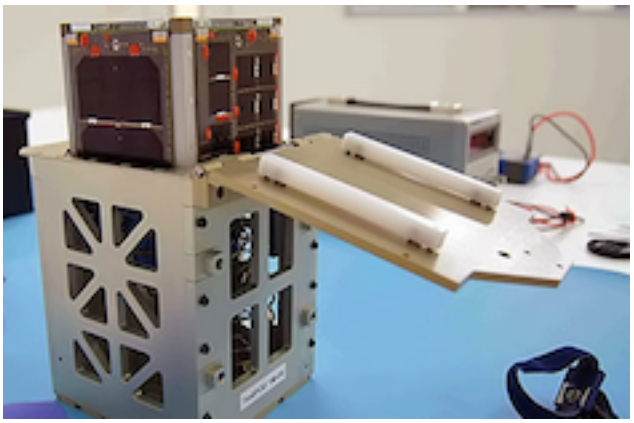
While the payload section successfully reached its initial orbit, the third out of five planned maneuvers failed. The engine had fired for only seven seconds instead of planned 18 minutes plus. The launch was insured. >>>

South Africa to launch "mini" nano-satellite into space

http://allafrica.com/view/group/main/main/id/00018802.html

A mini satellite weighing 1.2 kilograms, will be launched from the Cape Peninsula University of Technology (CPUT) in November to collect information about space weather.

To run on the same amount of power used by a 5-watt light bulb, "**ZACUBE-1**" cost much less and was 84 times smaller than Sputnik. I will be launched from Russia.



>>>

Ukraine and Brazil collaborate on Cyclone-Alcantara Spaceport Project

Above Left: Cyclone-4 **Above Right:** Map showing proximity of the **Kourou** and **Alcantara** space ports to the Equator

http://eng.obozrevatel.com/ukraine-and-the-world/**ukraine-ready-to-invest-in-alcantara-cyclone-space-joint-project-with-brazil**.htm

A joint venture to build the capacity to launch Ukraine's Cyclone-4 rockets from Brazil's Alcantara Spaceport has been resumed, aiming at a first launch in 2013. At just 2.3 degrees south longitude, (the closest to the equator of any spaceport, Alcantara is ideal for launching to geostationary orbit.

http://en.wikipedia.org/wiki/Alcântara_Launch_Center

"Brazil has the most advanced space program in Latin America, with significant capabilities in launch vehicles, launch sites, and satellite manufacturing."

The Ukraine does not have a launch site for its rockets. Brazil does not have rockets of its own, other than sounding rockets (the Sond and VS series) so this is an ideal partnership for both nations.

http://www.npointercos.jp/Cyclone4.html - **http://en.wikipedia.org/wiki/Tsyklon-4**

Cyclone-4 can launch satellites (either single or cluster) with a total mass of up to 5,300 Kg to the equatorial low earth orbit (LEO) or a 1,600 Kg satellite to geostationary transfer orbit (GTO)

http://www.globalsecurity.org/space/world/brazil/facility.htm

http://www.hobbyspace.com/nucleus/index.php?itemid=30291

http://www.hobbyspace.com/AAdmin/Images/Transport/Brazil/BrazilLiquidPropulsion.jpg >>>

US - Space-X First Operational Dragon Cargo Mission to ISS begins new Commercial Space Era

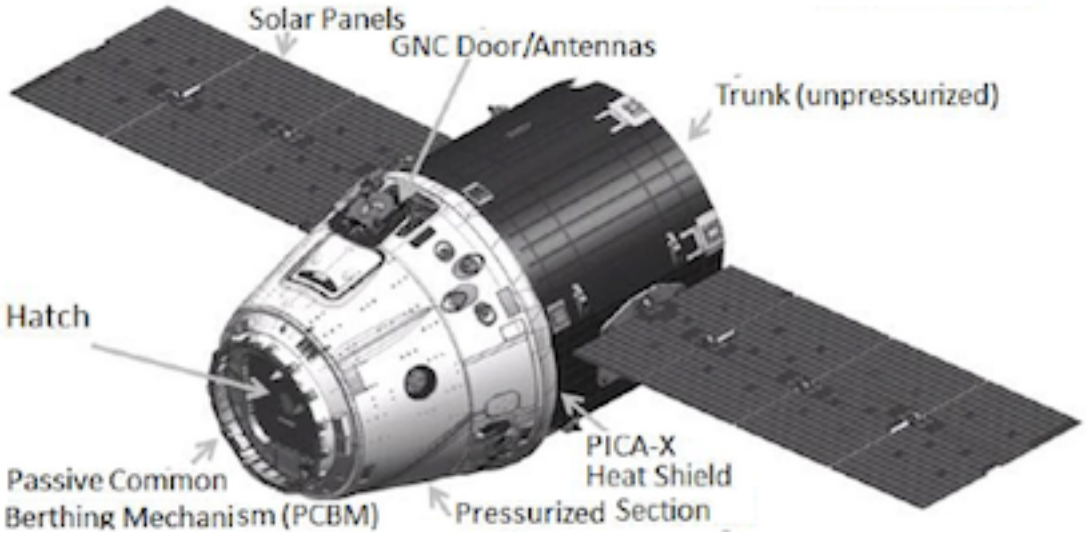
http://www.space.com/17943-**spacex-dragon-capsule-space-cargo-launch**.html

http://www.space.org/17945-lift-off-spacex-cargo-mission-launches-to-iss-video.html

October 7, 2012: The Falcon 9 rocket and its Dragon cargo carrier launched from Cape Canaveral Air Force Station in Florida as SpaceX "CRS-1." This was the first of 12 contracted flights of the Dragon capsule to the International Space Station. This follows a successful demonstration flight in May.

On this flight some 450 kg of supplies and critical materials were on board, needed for investigations planned by the Expedition 33 crew.

Dragon is the only cargo carrier capable of returning items to Earth safely. ESA's ATV, JAXA's HTV, and Roscosmos Progress freighters burn up in the atmosphere after leaving the station. Previously, NASA Space Shuttles were able to do this. So **the Space-X Dragon cargo vessel restores full functionality to the Space Station.**



http://www.spacex.com/dragon.php - **http://en.wikipedia.org/wiki/Dragon_(spacecraft)**

The Dragon capsule has 3 main parts:

- The Nosecone protects the craft and the docking adaptor during ascent
- The Spacecraft proper houses the crew and/or pressurized cargo plus the service section containing avionics, the RCS system, parachutes, and other support infrastructure;
- The Trunk provides stowage for unpressurized cargo and supports the solar arrays and thermal radiators.

The NASA contract

In December 2008, NASA announced the selection of **SpaceX**'s Falcon 9 launch vehicle and Dragon spacecraft to resupply the International Space Station (ISS) after the Space Shuttle retired. The $1.6 billion contract represents a minimum of 12 flights, with an option to order additional missions for a cumulative total contract value of up to $3.1 billion. Also selected were

Non-NASA Business opportunities

As a free-flying spacecraft, Dragon also provides an excellent platform for in-space technology demonstrations and scientific instrument testing. SpaceX is currently manifesting fully commercial, non-ISS Dragon flights under the name "DragonLab."

Other Companies with Commercial NASA Contracts

http://en.wikipedia.org/wiki/Commercial_Orbital_Transportation_Services

Orbital Sciences and **Alliant Techsystems** (ATK) are also developing spacecraft to service ISS.

Orbital Sciences is developing the **Cygnus** spacecraft - **http://en.wikipedia.org/wiki/Cygnus_(spacecraft)**

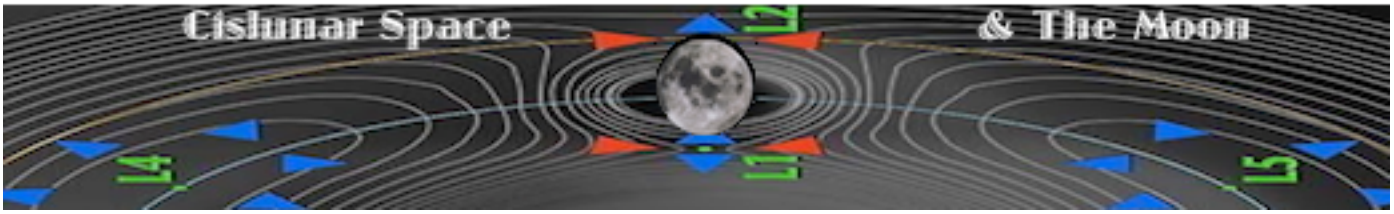
ATK is developing the **Liberty Rocket** - **http://en.wikipedia.org/wiki/Liberty_(rocket)**

This program is developing on schedule but future funding is not assured, given the continuing recession in the US economy. For those of us who want to see space travel become fully commercialized, as the best way to produce the most activity for the least cost, that would be most disappointing. ◘

Space-X tests "grasshopper" technology needed for "first stage rocket reusability"

http://www.space.com/17868-**spacex-grasshopper-reusable-rocket-test**.html

Photo: http://i.space.com/images/i/22369/original/**spacex-grasshopper-reusable-rocket**.jpg?1349217055



China to attempt its first Moon Landing 2nd half of 2013

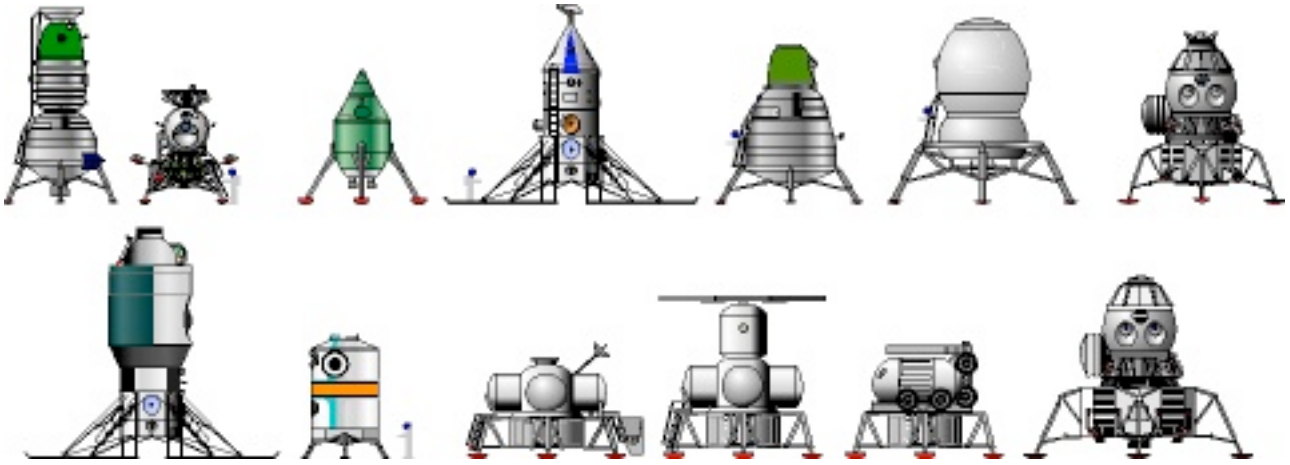
http://www.telegraph.co.uk/news/worldnews/asia/china/9440125/China-to-attempt-first-moon-landing.html

July 31, 2012 - China's ambitious Chang'e-3 mission, which includes both a lunar lander and rover, appears to be on schedule. **There has been no soft-landing on the Moon of any kind since** the Soviet Union's successful Luna 24 lander sample return mission touched down in Mare Crisium on 22 August **1976**, a gap of 37 years (by same date 2013) If successful, this mission will boost China's prestige significantly.

It appears unlikely that any of the Google Lunar X-Prize Moon lander teams will successfully reach the lunar surface in operating condition before 2014 at the earliest. But that too will be a significant feat, perhaps even more so, as it will demonstrate significantly more economical ways of achieving our goals in space. >>>

Russia Starts Building Manned Moon Ship

http://www.space-travel.com/reports/**Russia_starts_building_Moon_spaceship_eyes_Lunar_base**_999.html



Past Soviet Moon Lander Design Sketches

The "final" moon lander module design? - http://www.astronautix.com/graphics/l/lkoverhd.jpg

July 24, 2012 Aiming at a test flight in 2015, Roscosmos has begun design of a spacecraft capable of taking a manned capsule to the Moon. A first manned Moon landing would not occur before 2018, hopefully winning the race to "be next" after the American feat in 1969, some 49 years earlier.

This project requires construction of a whole system: perhaps 3 rocket stages, a manned lunar orbiter which would bring the cosmonauts back to Earth, and a 2-stage landing/departure craft - if the architecture of the NASA Moon missions is followed. Russia could, however, revisit the old Soviet Union plans for manned Moon landings dating from the 1960s.

http://en.wikipedia.org/wiki/Soviet_manned_lunar_programs

http://www.fas.org/spp/eprint/lindroos_moon1.htm

http://www.zmescience.com/science/astronomy/lk-lander-the-soviet-moon-landing-program-photos/

http://www.astronautix.com/craft/lk.htm

Much depends on whether Russia's commitment to support the International Space Station is to be extended past 2020, when current international commitments expire. "It is necessary to determine the main direction of manned cosmonautics development. Current strategy envisages focusing on the manned flights to the Moon, including the creation of a base on its surface," said head of the Central Research Institute of Machine Building Gennady Raikunov.

Long range Roscosmos plans include manned Moon landings as a stepping stone to a manned mission to Mars. It must be kept in mind, however, as a reality check, that Russian funding for Roscosmos is very minimal. But with China hoping to land a Taikonaut on the Moon in 2020, Russian pride may force a funding sea-change Having lost the first "Moon Race," Russia would not want to lose a second time. That said, China's space program is in high gear, Russia's just hobbling along in paper studies. >>>

NASA (US) & CSA (Canada) Lunar Analog Exercise in Hawaii

http://www.nasa.gov/home/hqnews/2012/jul/HQ_12-237_NASA_Hawaii_Missions.html

Hilo, Hawaii Island, HI, USA July 19, 2012 - This month, NASA conducted **a nine-day field test** outside Hilo, **to evaluate new exploration techniques for the surface of the Moon.** Analog mission simulations are conducted in terrain that in some ways resembles that of the Moon, or Mars as the case may be. Analog locations are often in remote areas. The top analog sites in North America are the SE deserts (NASA Desert RATS), in Utah (Mars Desert Research Station, on Canada's far north Devon Island (Mars Arctic Research Station and the Haughton-Mars Project) and here on Hawaii Island (PISCES.)

This Mission was a collaboration with the Canadian Space Agency and with the Pacific International Space Center for Exploration Systems (PISCES) whose members include State of Hawaii, Canada, Japan, and Germany.

Previous articles on PISCES in M3IQ

M3iQ #11 p. 29 "International Lunar Research Park Proposed'

M3IQ #13 p. 41 "Creating a Foundation in Hawaii for "The Next Giant Leap" Pisa, Pisces, and ILRP" - Dave Dunlop

Canadian Space Agency (CSA)'s **Artemis Jr. rover** holds the Regolith and Environment Science and Oxygen and Lunar Volatiles Extraction (RESOLVE) instruments to drill for water ice and other resources during a simulated mission. Photo: NASA/Joe Bibby

The test area has lava-covered mountain soil similar to the 3+ billion years old volcanic plains ("mare" singular, "maria" plural) on the Moon. The rover and its onboard instrumentation are c. 79 cm tall and weigh about 300 kg, three times more than equipment to be used on an actual mission.

Most PISCES analog activities are set on the slopes of Mauna Kea, a dormant shield volcano.

The two main tests are the Regolith and Environment Science and Oxygen and Lunar Volatile Extraction (RESOLVE) and Moon Mars Analog Mission Activities (MMAMA), a group of small projects and tests to define the requirements for navigation, mobility, communications, sample processing, curating and other critical elements in future science/exploration missions.

The ultimate goal is to be able to use local resources on the Moon and Mars in order to lessen the mass of tools and materials that must be brought from Earth at great expense. This avenue of research is called "In SITU" meaning on site resource usage. If we are to explore the Moon and Mars more extensively, and go on to establish permanent outposts, such use of local resources and the materials that can be made from them is absolutely critical.

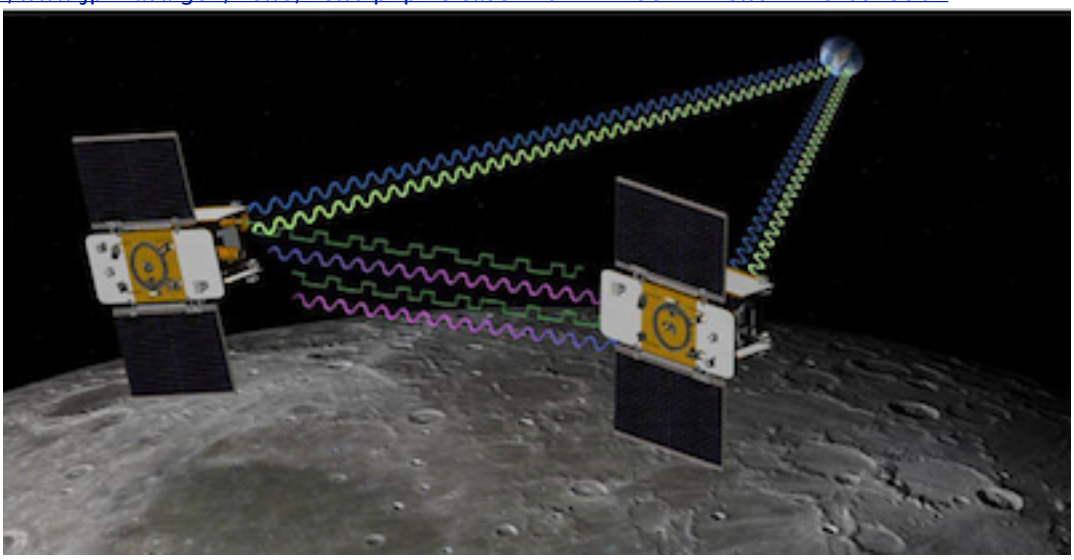
When it is fully developed, PISCES will feature a simulated lunar outpost (robotic and human) on the Island of Hawaii. PISCES is leading the effort in the **International Lunar Research Park** concept by laying the foundations for integration, testing, validation and verification of technologies and systems for this global project.

links: http://pisces.uhh.hawaii.edu/ - https://sites.google.com/site/internationallunarresearchpark/ >>>

UNITED STATES - NASA GRAIL Mission Update

GRAIL Gravity Recovery and Interior Recovery

http://en.wikipedia.org/wiki/GRAIL - http://www.nasa.gov/mission_pages/grail/main/index.html
http://solarsystem.nasa.gov/grail/home.cfm
http://www.jpl.nasa.gov/news/news.php?release=2012-273&rn=news.xml&rst=3502



August 31, 2012 - the original mission completed, and both craft "**Ebb**" and "**Flow**" (after the two types of tidal movement) in good condition, NASA has extended the mission from August 30 to December 3,2012.

Both craft have descended to a lower altitude above the Moon so that gravity and density measurements can be taken at higher resolution, yielding information about the surface and subsurface beyond the expectations for the original mission. "deriving the gravitational influence of surface and subsurface features as small as simple craters, mountains and rilles," "flying at the lowest altitude that can be safely maintained" "half of the original altitude above the surface."

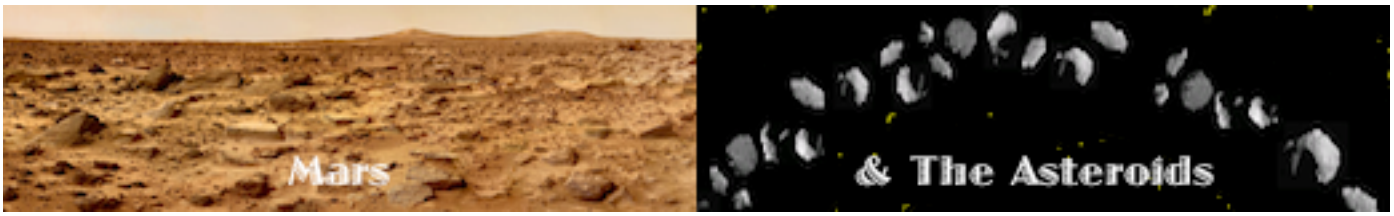
There is some hope that at this higher resolution, some of the larger near-surface lava tubes may be mapped, if passing over them reveals linear areas with a very slight dip in gravity in comparison with the surrounding terrain. This would be an exciting bonus for this mission. >>>

Chandrayaan-2 Moon Lander/Rover Mission Update

http://www.ndtv.com/article/india/**india-s-next-moon-mission-depends-on-russia-isro-chief**-264928

According to ISRO Chairman K. Radhakrishnan. According to the original plan India will build the Orbiter and the Rover, and Russia is to supply the Lander. If Russia fulfills its part in time, the mission could still fly in 2014.

But given recent Russian failures with the Phobos-Grunt mission and other launches, there is real uncertainty about Russia's ability to do its part. However the mission does not depend on a Russian launch. ISRO has from the very beginning planned to use its heavier rocket - the Geosynchronous Satellite Launch Vehicle (GSLV) for this mission. Accordingly, for now, there seems no reason to presume the launch would be delayed. >>>



India may be the 3rd* nation to reach Mars

While "**Curiosity,**" NASA's most ambitious Mars rover yet, does its work on the Martian surface, in little more than a year, if all goes as now planned, **India's Mangalayaan**-1** **Mars orbiter** will be on its way to Mars to learn more about Mars from above, in an eccentric orbit that ranges from 500 x 80,000 km above the surface. The probe will take about 10 months to reach Mars orbit in 2014.

http://space.skyrocket.de/img_sat/**mangalyaan__1**.jpg
http://4tvhyd.com/4tvnews/index.php/2012/09/india-to-launch-mars-mission-in-2013/

China's **Yinghuo-1** probe was launched on November 8, 2011, piggybacking a ride with the Russian Phobos-Grunt probe. While there was no problem with either probe, once in Earth orbit, the second rocket stage failed to ignite and both probes disintegrated in Earth's atmosphere as the initial orbit degraded.

* The Soviet Union (space agency now Russia's Roscosmos) **Mars 2** crash landed on Mars in 1971. US NASA Mars probes reached Mars as flybys, orbiters, and landers **1973-76**. - http://en.wikipedia.org/wiki/Exploration_of_Mars

** The Sanskrit and Hindi for Mars is मंगल or **Maṅgala**. >>>

ESA/Russian EXO-MARS project Advances

http://www.marsdaily.com/reports/ExoMars_program_gathers_strength_999.html

July 23, Moscow - Exo-Mars was initially an ESA-NASA collaboration, but when, under acute budget pressures, NASA withdrew, in February of this year, Russia's Roscosmos eagerly stepped in to restore the viability of this exciting Mars exploration project.

The two agencies are expected to sign an agreement on the implementation of the second stage of the ExoMars program this fall, headed for a 2018 launch window. Russia would assume half of the work load. “Several spacecraft elements to be sent to Mars on two launches. The launch of Entry, Descent and Landing Demonstrator Module (EDM), as well as the Trace Gas Orbiter (TGO) is scheduled for 2016.”

ESA will be responsible for the EDM, Roscosmos for the TGO. Russian made instruments “will include three infra-red spectrometers, designed to study Mars' atmosphere for sources of methane, carbonic dioxide and water.

spectrometers will also help monitor temperature in the atmosphere," Zakharov says. "The Russian equipment on the ExoMars will also include a neutron detector to study water distribution under Martian ground up to 1 meter deep."

Scientists want to find out how Methane originated on Mars as there are no volcanoes on Mars which are one of the sources of this gas and it could have a biological origin. NASA’s Curiosity, now on Mars, will be monitoring Methane levels as well.

The landing platform, which was designed by Russia's Lavochkin scientific development and production center, will deliver the European mars rover to the planet’s surface.

ESA Exo-Mars Site: http://exploration.esa.int/science-e/www/area/index.cfm?fareaid=118

Testing Exo-Mars instruments on Earth: http://www.esa.int/esaSC/SEMMQCERI7H_index_0.html (**video**) >>>

UNITED STATES - **Mars Science Lab “Curiosity” lands successfully!**

In the control room at NASA’s Jet Propulsion Laboratory in Los Angles, California, it was pandemonium, 10:23 pm Pacific Time, August 5, 2012 as the feed came in confirming that Curiosity had landed safely, in operating condition, right where it was intended to land, in by far the most complicated landing procedure ever attempted.

Watch **Control RoomVideo** (landing sequence animated) **http://www.youtube.com/watch?v=N9hXqzkH7YA**

Links: http://www.space.com/16801-**mars-rover-curiosity-science-instruments-infographic**.html

http://www.marsdaily.com/reports/**Mars_rover_takes_cool_detour**_NASA_999.html

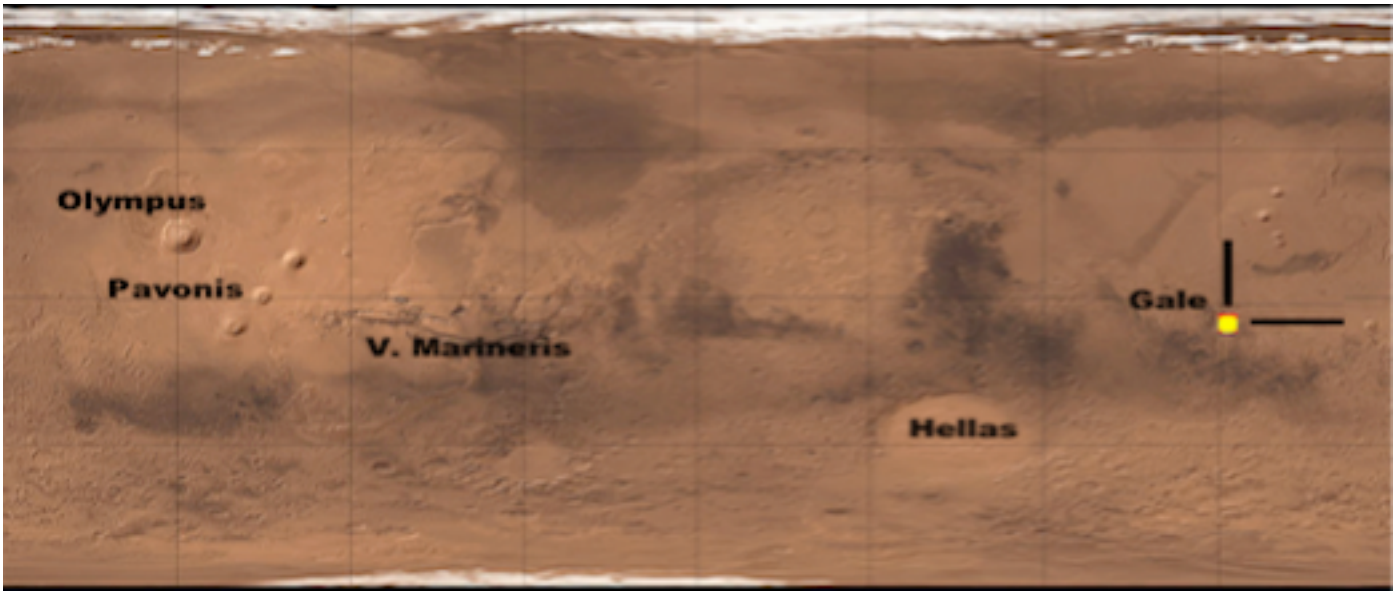
http://www.space.com/17243-**mars-rover-curiosity-test-drive-coded-tracks**.html

http://www.space.com/17238-**mars-rover-curiosity-ray-bradbury-memorial**.htm

Videos: http://www.space.com/17235-**curiosity-s-first-drive-on-mars**-video.html

http://www.space.com/17608-**was-ancient-mars-a-wetter-place-curiosity-will-look-for-the-evidence-video**.html

Just where is Gale Crater?



http://en.wikipedia.org/wiki/Gale_(crater)

“**Gale** is a crater on Mars near the northwestern part of the Aeolis quadrangle at 5.4°S 137.8°E.[2] It is 154 km (96 mi) in diameter[1] and estimated to be about 3.5–3.8 billion years old.[3]

The crater was named after Walter Frederick Gale, an amateur astronomer from Sydney, New South Wales, Australia, who observed Mars in the late 19th century.[4] Aeolis Mons is a mountain in the center of Gale Crater and rises 5.5 km (18,000 ft) high.[5][6]

Aeolis Palus is the plain between the northern wall of Gale Crater and the northern foothills of Aeolis Mons.[5][6] The NASA Mars rover, Curiosity, of the Mars Science Laboratory (MSL) mission, landed in "Yellowknife" Quad 51[7][8][9][10] of Aeolis Palus in Gale Crater at 05:32 UTC August 6, 2012.[11]

NASA named the landing location Bradbury Landing on August 22, 2012.[12] Curiosity is expected to explore Aeolis Mons and surrounding areas.”

How Curiosity Works – **http://science.howstuffworks.com/mars-curiosity-rover.htm**

Curiosity's Rocker-bogie 6-wheel suspension – **http://en.wikipedia.org/wiki/Rocker-bogie**

Slow crawl – **http://www.space.com/17220-mars-rover-curiosity-martian-driving.html**

"Curiosity's drivers guide the six-wheeled robot — not with a joystick, but via commands uploaded on a daily basis." "The rover may be powered off while we're actually doing our planning, and so we'll have eight or more hours to do our sequencing," said Jeff Biesiadecki of NASA's Jet Propulsion Laboratory in Pasadena, Calif. "Then we'll send up a command load to the rover and tell it step-by-step what it needs to do."

http://www.guardian.co.uk/science/blog/2012/aug/05/mars-curiosity-rover-slower-speeding-snail

"20 meters per day" Note that while it takes less than 3 seconds to get a signal to the Moon and back, it takes from 6-40 minutes to get a signal to get a signal to Mars in back. Why? The Moon orbits Earth at a distance that varies little over the month. Mars orbits the Sun independently of Earth, on its own pace so that the Earth – Mars distance varies enormously.

Science goals – http://science.nasa.gov/science-news/science-at-nasa/2011/26nov_msllaunch/

"Curiosity's ambitious science goals are among the mission's many differences from earlier Mars rovers. It will use a drill and scoop at the end of its robotic arm to gather soil and powdered samples of rock interiors, then sieve and parcel out these samples into analytical laboratory instruments inside the rover. Curiosity carries 10 science instruments with a total mass 15 times as large as the science-instrument payloads on the Mars rovers Spirit and Opportunity. Some of the tools are the first of their kind on Mars, such as a laser-firing instrument for checking the elemental composition of rocks from a distance, and an X-ray diffraction instrument for definitive identification of minerals in powdered samples." "To haul and wield its science payload, Curiosity is twice as long and five times as heavy as Spirit or Opportunity."

http://mars.jpl.nasa.gov/msl/mission/science/goals/

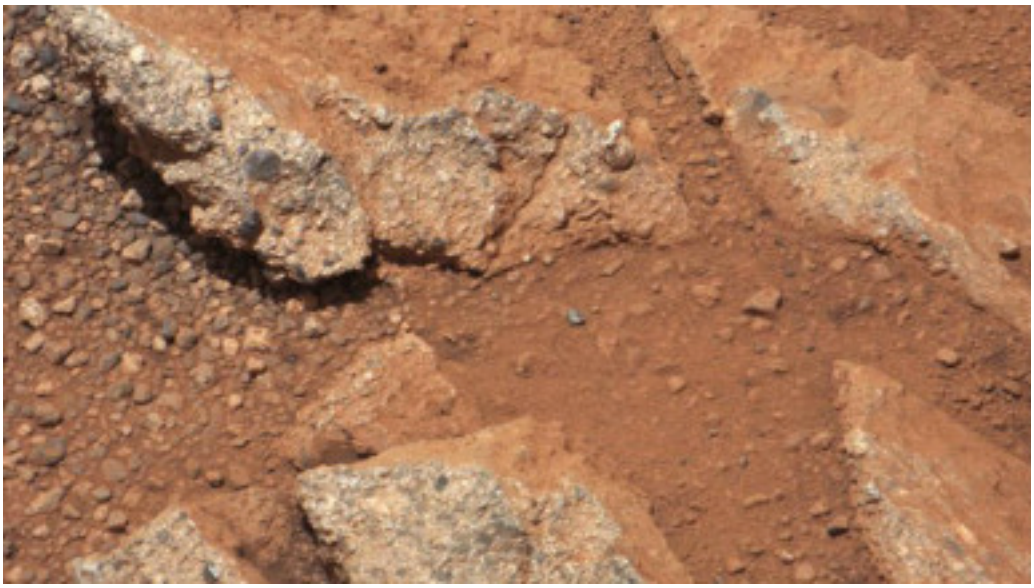
Goal 1: Determine whether life ever arose on Mars
Goal 2: Characterize the climate of Mars – for details check link above
Goal 3: Characterize the geology of Mars – for details check link above
Goal 4: Prepare for human exploration – for details check link above

Curiosity finds proof of a steady running river on Mars long ago

FLASH: September 27, 2012 – http://www.nasa.gov/mission_pages/msl/news/msl20120927.html

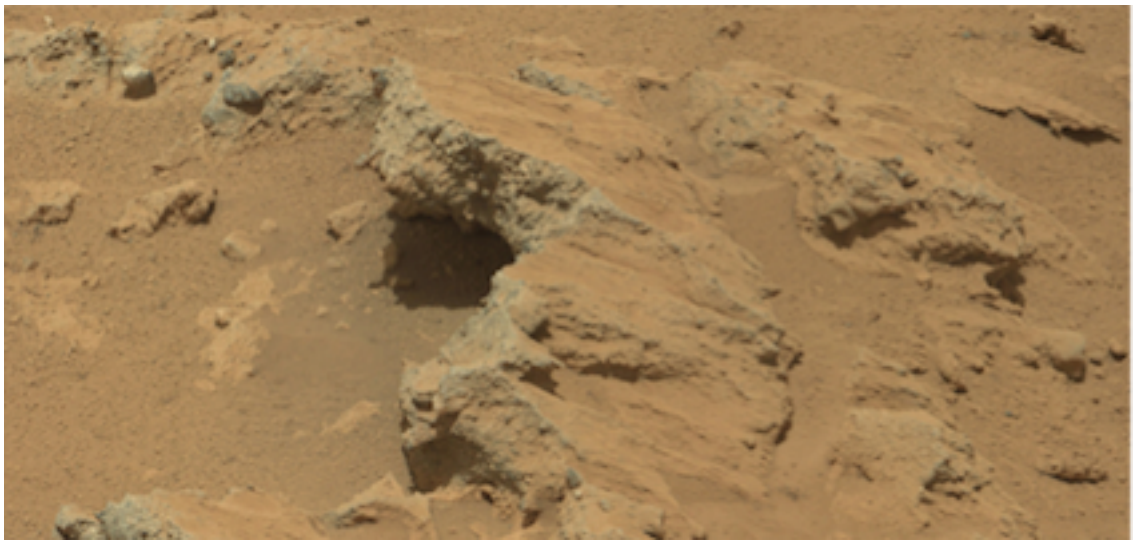
"The Curiosity Rover has found evidence of an ancient stream that flowed vigorously on Mars where the Rover is now exploring," NASA said on Thursday. "This is "definitive proof" that water once existed on Mars. ... Stream bed gravels were observed among the rocks on the surface of Mars."

"From the size of gravels it carried, we can interpret the water was moving about 3 feet per second, with a depth somewhere between ankle and hip deep," said Curiosity science co-investigator William Dietrich of the U. of California, Berkeley. "The rock outcrop was named "Hottah" after Hottah Lake in Canada's Northwest Territories."



Additional images: http://www.huffingtonpost.com/2012/09/27/**mars-stream-photos-images**_n_1920770.html

It was just the hope of such a discovery that led to Curiosity being directed to an "alluvial fan" like area in Gale Crater.



Another amazing photo: http://www.nasa.gov/images/content/692229main_pia16156-673.jpg
Helpful Infographic: http://www.space.com/17805-**mars-water-streambed-curiosity-rover-infographic**.html
Video: http://www.space.com/17797-**water-rushed-on-mars-curiosity-finds-video**.html

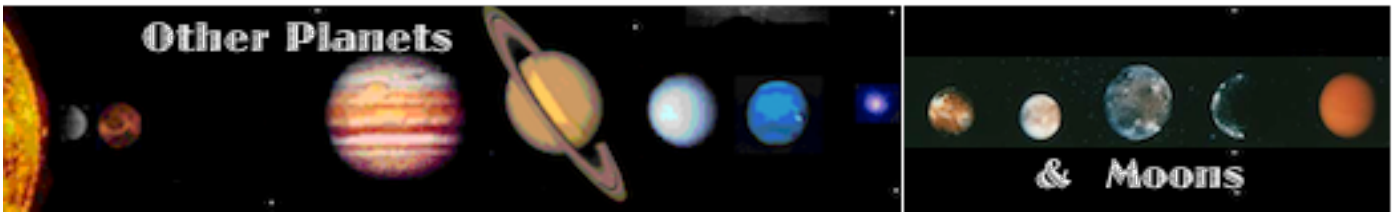
One of Curiosity's primary goals has been to determine whether or not water once flowed on Mars surface, and if so, for how long. There have been two "camps" one postulating a wet Mars, another a dry cold Mars. This find is a long way from being evidence that Mars once supported life, but it means that the emergence of life on Mars cannot be ruled out. Curiosity's findings in the months to come, may provide powerful motivation for a carefully directed "Sample Return Mission," and indeed for future human exploration missions to Mars. It is also encouraging information for those who believe that a sustainable human presence on Mars is possible. **PK**

INDIA - Renjith Kumar: **The Indian Businessman who landed Curiosity**

http://timesofindia.indiatimes.com/photo/15455733.cms
http://articles.timesofindia.indiatimes.com/2012-08-12/special-report/33166917_1_**mars-science-laboratory-mars-rover-mars-pathfinder**

"The world watched as Curiosity, the Mars rover, triumphantly landed on the red planet this week. There were whoops of joy and euphoria among those who had toiled for years to make this possible. But for one Virginia-based Indian entrepreneur and engineer, it was a moment of quiet elation. Dr. Renjith Kumar, 49, is the CEO of a company which was closely involved with the rover's Entry, Descent, and Landing (EDL), or what is now being famously called the "seven minutes of terror."

Read the whole article (link above) **for more information** on Analytical Mechanics Associates (AMA), Kumar's company, and on Kumar's career. >>>



US/NASA: Dawn probe departs Vesta for Ceres

http://www.allvoices.com/contributed-news/12925489-nasa-probe-dawn-departs-from-asteroid-vesta-en-route-to-dwarf-planet-ceres

After mapping and studying the amazing asteroid Vesta for 13 months, Dawn left its orbit around this fascinating mini-word on a new trajectory bound for the largest asteroid, now considered a "dwarf planet," Ceres. Vesta may have originally been spherical, but impacts have flattened it considerably, but Ceres which is half again as large in diameter, is expected to be more spherical in shape. Scientists also expect it to have an ice-rock crust which might be hiding an ocean underneath, much like Europa. That opens the door for the possibility that life may have originated on Ceres, then possibly have spread to Mars, then Earth, as Ceres would have reached a stage where it could give rise to life, before Mars, which in turn could have harbored life before conditions were ripe on Earth.

Dawn is expected to arrive at Ceres in 2015, and go into orbit around it. Meanwhile, the New Horizons probe should be reaching Pluto and its sister world Charon that same year, but just for a flyby.

Some Vesta links: http://en.wikipedia.org/wiki/4_Vesta

http://www.space.com/17389-take-a-tour-of-vesta-the-giant-asteroid-explored-by-nasa-s-dawn-spacecraft-video.html

http://news.discovery.com/space/protoplanet-vesta-asteroid-dawn-120510.html

http://www.time.com/time/health/article/0,8599,2114774,00.html

http://www.nasa.gov/mission_pages/dawn/news/dawn20120425.html

Some Ceres Links:

http://en.wikipedia.org/wiki/Ceres_(dwarf_planet)

http://www.britannica.com/EBchecked/topic/103501/Ceres

http://www.solarviews.com/eng/ceres.htm

http://www.lpi.usra.edu/decadal/sbag/topical_wp/AndrewSRivkin-ceres.pdf

Ceres, Vesta, and Europe Size comparison

Ceres' surface slightly is larger than Argentina, slightly less than India, comparable to the US East of the Mississippi. Ceres' gravity is 2 % Earth normal or 1/6th that of the Moon (in turn is 1/6th that of Earth)

We wish Dawn a good journey! >>>

UNITED STATES – **NASA planetary probes**

Probes operating at Destination

Cassini – Saturn and its moons

http://www.nasa.gov/mission_pages/cassini/timeline/index.html

http://en.wikipedia.org/wiki/Cassini-Huygens_timeline

Cassini entered the Saturn system May 18, 2004. In its elongated orbit, the orbiter probe continues to probe Saturn's secrets (rings, atmosphere and more) ad well as its many moons, including perhaps the most intriguing world in the Solar System, **Titan.**

Recent Titan Updates:

http://www.nasa.gov/mission_pages/cassini/whycassini/cassini20120829.html Titan's true colors

http://www.nasa.gov/mission_pages/cassini/whycassini/cassini20120710.html Titan's seasons

http://science.nasa.gov/science-news/science-at-nasa/2012/28jun_titanocean/ Titan's underground ocean

http://www.space.com/17829-titan-lakes-boat-talise-mission.html – a boat to explore Titan's largest Lake?

June 28, 2012: Data from NASA's Cassini spacecraft have revealed Saturn's moon Titan likely harbors a layer of liquid water under its ice shell. The finding appears in today's edition of the journal Science. "Cassini's detection of large tides on Titan leads to the almost inescapable conclusion that there is a hidden ocean at depth," said Luciano Less, the paper's lead author and a Cassini team member at the Sapienza University of Rome, Italy. "The search for water is an important goal in solar system exploration, and now we've spotted another place where it is abundant."

Titan Flyby dates: There were 12 Titan encounters in 2012 through September 28th with two more scheduled.

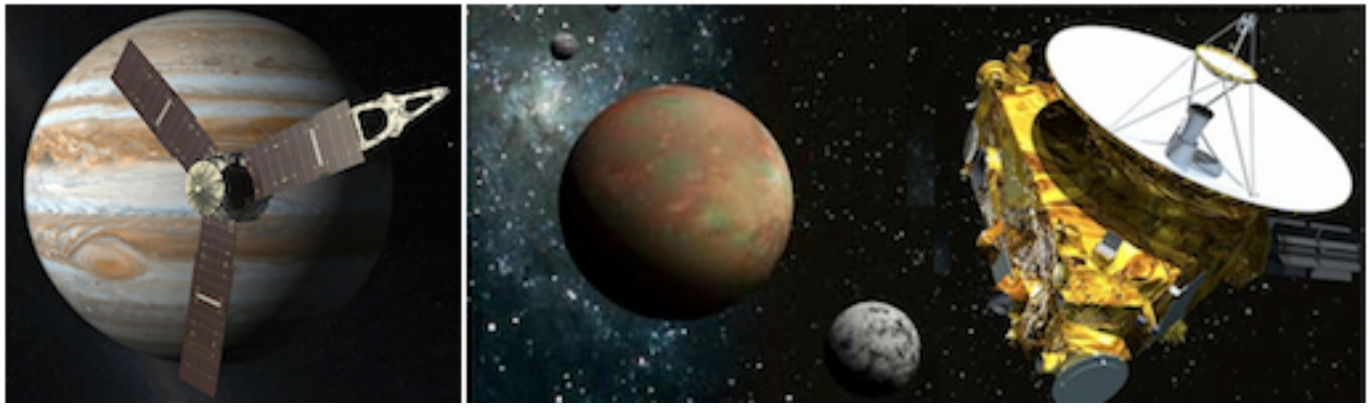
Detail mission goals of each Titan encounter: http://saturn.jpl.nasa.gov/mission/saturntourdates/

Probes en route

Juno – "unlocking Jupiter's Mysteries" [left below]

http://www.nasa.gov/mission_pages/juno/overview/index.html

On September 14th, Juno will get a gravity assist from a flyby of Earth on Oct. 9, 2013. Juno will arrive at Jupiter on July 4, 2016. "Once in orbit, the spacecraft will circle Jupiter 33 times, from pole-to-pole, and use its collection of 8 science instruments to probe beneath the gas giant's obscuring cloud cover. We will learn about Jupiter's origins, structure, atmosphere and magnetosphere, and look for a potential solid planetary core."



Left: Juno shown over Jupiter – Right: New Horizons – Pluto-Charon flyby through Kuiper Belt

New Horozons Pluto-Charon flyby and Kuiper Belt probe

Where is New Horizons now? – http://pluto.jhuapl.edu/mission/mission_timeline.php

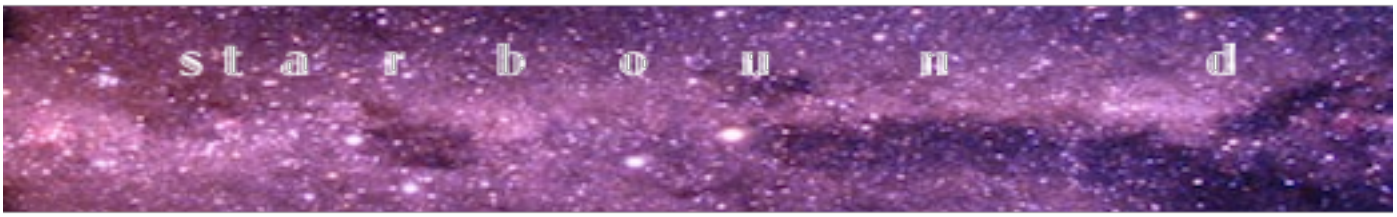
New Horizons has **crossed the orbit of Uranus March 18, 2011,** with **Neptune** coming up in **August 2014**. Its closest flyby approach to **Pluto-Charon** will be in **July 2015**.

Why will the probe not go into orbit around Pluto? – http://pluto.jhuapl.edu/mission/missionFAQs.php

First there is an engineering reason. To get to Pluto (5 billion kilometers or 3 billion miles from Earth) in just 9.5 years, as New Horizons will, the spacecraft must travel very, very quickly. As a result, New Horizons will speed by Pluto at a velocity of about 43,000 kilometers per hour (27,000 miles per hour). To get into orbit, operators would have to reduce that speed by over 90%, which would require more than one thousand times the fuel that New Horizons can carry.

The second is that If we did stop to go into orbit, we wouldn't be able to go on to explore the Kuiper Belt!

>>>



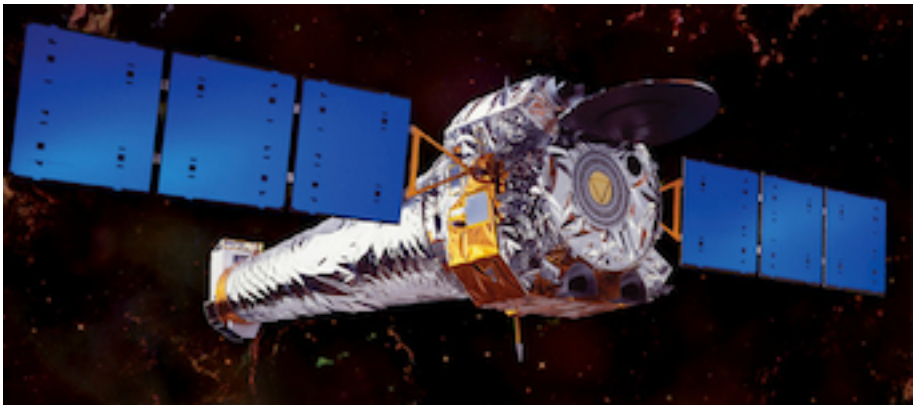
Giant Gas Cloud Discovered Surrounding our Milky Way Galaxy
May contain "missing baryon mass"

http://www.space.com/17734-**milky-way-galaxy-giant-gas-halo**.html
http://io9.com/astronomy/
http://www.sciencedaily.com/releases/2012/09/120924123046.htm

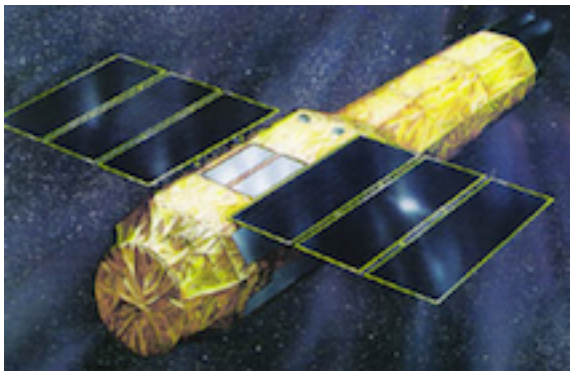
"Astronomers have discovered a cloud of gas engulfing our Milky Way galaxy that weighs as much as all the stars inside our galactic home. If the size and mass of this cloud is confirmed, it may solve a longstanding astronomical mystery." - from first link above

The research leading to this unexpected conclusion is the work of an international collaboration. The halo's temperature, size and mass were estimated using data from

- NASA's **Chandra X-Ray Observatory**,
- European Space Agency's **XMM-Newton space observatory** and
- Japan's **Suzaku** satellite



Above: NASA's Chandra X-ray Observatory CREDIT: NASA/CXC



Left: ESA's XMM-Newton Space Observatory - **Right:** Jaxa's Suzaka satellite

If confirmed, this explanation may supplant the hypothesis that we are surrounded by unobservable dark matter, at least in part.

Anjali Gupta is the lead author of the paper. Ms Gupta is a Postdoctoral Researcher at the Ohio State University Dept. of Astronomy in Columbus, Ohio, US. Her area of research includes Active Galactic Nuclei and X-Ray Astronomy. >>>

100 Year Starship Symposium Kicks Off to Ponder Interstellar Travel

http://www.space.com/17568-**100-year-starship-symposium-kicks-off**.html

http://www.youtube.com/watch?v=1VvWNV6W89M **DARPA-NASA One Hundred Year Starship Study**

Video: http://www.youtube.com/watch?v=LDDRnrun2Ik

Report and Comments by Peter Kokh

The Challenge in a nutshell

The dream of traveling to the Stars has been around since we first realized that the stars were other suns, not just lights on a fixed firmament shell centered not on our Sun, our Star, but on Earth. But as we realized how very far away even the closest stars are (**Sirius**, at 8.6 light years away is the closest star easily visible from northern latitudes. **Alpha Centauri**, at 4.3 light years is the closest so far discovered, but visible only from further south. Contrast this with **Pluto**'s distance which varies from 4-6 light hours! and the Moon's distance which is about 1.5 light seconds.

After 35 years, **Voyager 1** is now only 122 times further out from the Sun as Earth is, or less than 17 light hours out. If Voyager 1 had been aimed at Alpha Centauri, 272,000 times the Earth-Sun distance [1 Astronomical Unit or A.U.] it would reach it in another 78,000 year Now **if we could travel 1,000 times faster than Voyager 1, we could reach our neighbor in 78 years**, not counting time taken to reach that speed and then to decelerate from it.

For most people, star travel has remained exclusively within the domain of science-fiction.but to the British Interplanetary Society and people like Mark Millis and others who suspect that there may be a way to make and end run around the speed of light barrier, the dream is still alive.

The 100-year starship effort - http://100yss.org/initiative

"The 100 Year Starship™ will make the capability of human travel beyond our solar system to another star a reality over the next 100 years. 100YSS™ will embark on a journey across time and space … If my language is dramatic, it is because this project is monumental. And our team is both invigorated and sobered by the confidence DARPA has in us to make interstellar flight a reality."

The 100-year starship project in the news

- May 17, 2012 - **Mae Jemison and Team Establish 100 Year Starship® With Goal to Make Interstellar Space Travel Reality by 2112** - http://100yss.org/wp-content/uploads/2012/05/100YSS-Press-release-0517.pdf
- May 23, 2012 - **DARPA, the U.S. Defense Advanced Research Projects Agency, gives a $500,000 grant to the 100 year starship project**- http://100yss.org/wp-content/uploads/2012/06/Washington-Post-article-23-May-2012.pdf

Other Links

- http://www.space.com/17703-**interstellar-spaceflight-challenges-humanity**.html
- http://www.space.com/17619-**how-interstellar-travel-works-infographic.**html
- http://www.space.com/17617-**interstellar-spaceflight-100-year-starship**.html
- http://www.dailymail.co.uk/sciencetech/article-2199247/**The-100-year-Starship-project-plans-transport-humans-solar-system**.html
- http://en.wikipedia.org/wiki/**Hundred-Year_Starship** - http://www.centauri-dreams.org/?p=24888
- http://www.thespacereview.com/article/2161/1 - http://www.**tauzero.**aero/html/**human_impact**.html

Why Humans May Be the Biggest Hurdle for Interstellar Travel

http://www.space.com/17703-**interstellar-spaceflight-challenges-humanity.**html

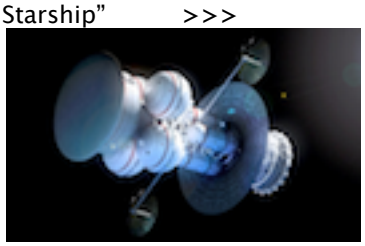
It is one thing, challenging as it is, to design and engineer a "starship probe" that could reach a nearby star within one century, let alone within one generation. It is quite another to design a "passenger starship" as that means keeping humans alive, or in suspended animation, over generations. If suspended animation is not used, would the descendants of the original crew want to debark, having lived in close quarters (however pleasant) all their lives?

Sending humans means building a much larger ship, equipped to maintain a biosphere that will remain fully functional for generations, providing food and other consumables, recycling 100%, without the possibility of resupply.

A work-around would be to send only frozen human eggs and sperm, or inseminated eggs at an early stage, plus robots and nanny robots that, upon nearing a target star confirmed to have an Earth-like planet (oceans, continents, breathable atmosphere, vegetation, etc.) would unfreeze them, bring them to term, raise and educate them to the adult stage, etc. If the planet proved to be uninhabitable, the ship could be retargeted, the frozen embryos remaining frozen.

Images: Any current designs of starships are likely to be as "quaint" (once we are actually able to build one) as Jules Verne's visions of spaceships are to us today. So the wise advice would be not to take any of these designs seriously. That said, you will find some designs by doing a Google Images Search for "100 year Starship" >>>

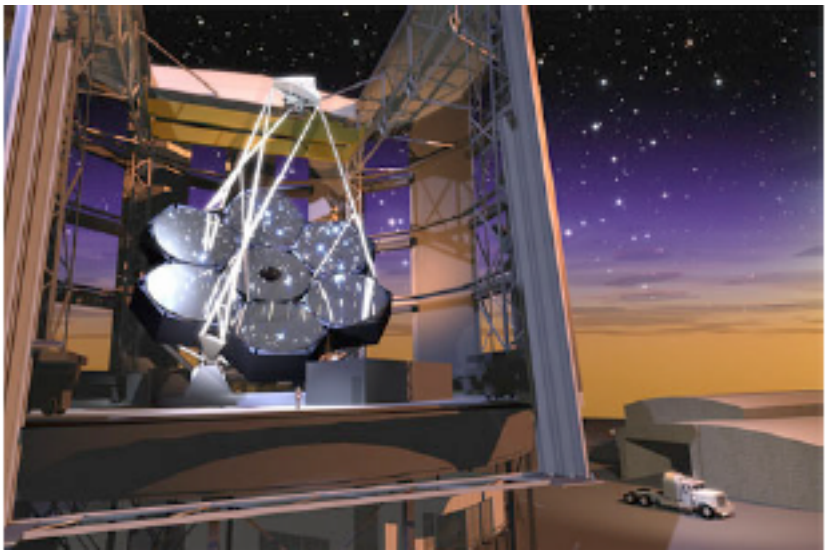


Australia to build "Super Telescope" in Chile

http://www.asianscientist.com/topnews/australian-scientists-build-super-sized-telescope/

April 18, 2011 Researchers at the Australian National University are helping to build a super-sized telescope that will allow scientists to see deeper into space in the visible light range. Called the Giant Magellan Telescope (GMT), it will have a primary mirror 24.5 meters in diameter and produce images up to 30 times sharper than existing ground-based telescopes. The GMT will be built, not in Australia, but in northern Chile's Atacama Desert, the world's premier observing site for clarity and dryness of the air.



The instrument should be operational by the end of the decade (2020). Australia is contributing enough money to build the instrument and to "buy observing time" for Australian astronomers.

Australian National University - http://anulib.anu.edu.au/

Chile's Atacama Desert - World's Space Observatory Mecca:

http://www.dailygalaxy.com/my_weblog/2007/08/the-driest-plac.html **>>>**

Other New Telescopes

http://en.wikipedia.org/**wiki/List_of_largest_optical_reflecting_telescopes** (as of 2009)

The 5 Most Powerful Telescopes, and 5 That Will Define the Future of Astronomy

http://www.popularmechanics.com/science/space/**telescopes/4299775**

Still under construction, ALMA, in northern Chile, is the most powerful telescope of its kind in the world

http://www.gizmag.com/alma-telescope-first-image/20050/

(Photo: W. Garnier, ALMA (ESO/NAOJ/NRAO)

SKA (Square Kilometer Array) (part in Australia/New Zealand, part in South Africa/Africa) **Update:**
http://www.engineeringnews.co.za/article/ska-phase-1-will-involve-the-construction-of-250-dish-antennas-2012-05-29 >>> **For news on the Australian component, see next page.**

36 Dishes of the Australian Square Kilometre Array begin Searching Universe

http://www.smh.com.au/technology/sci-tech/**mighty-telescope-begins-scouring-universe**-20121005-273mp.html

The Australian Square Kilometre Array Pathfinder is the world's most powerful telescope system.
October 5, 2012 - In remote Murchison, 315 km NE of Geraldton, Western Australia, the complex opened today.

"The $400 million project has already been booked out for its first five years by 350 international researchers, who will conduct projects including a census of galaxies within several billion light years of Earth, and studies of magnetic fields and black holes. .... part of the science program would be the search for intelligent life."

36 dishes will in time be joined by 60 more, all incorporated into phase one of **the international SKA project, hosted jointly by Australia-New Zealand and South Africa**. The project is capable of detecting low and middle-level frequencies, while a sister project in South Africa [bottom previous page] will focus on high frequencies.

The Australian SKA would be able to detect 40 gigabytes per second. "In the first full day of operation, ASKAP will generate more information than exists in the US Library of Congress. In fact, that is more information than all the radio astronomy archives around the world today ... In one day the SKA will generate more information than the equivalent of all the words spoken by the human race." **more:** http://www.atnf.csiro.au/projects/mira/

"Tatooine" Twin Sun Solar Systems may not be Uncommon

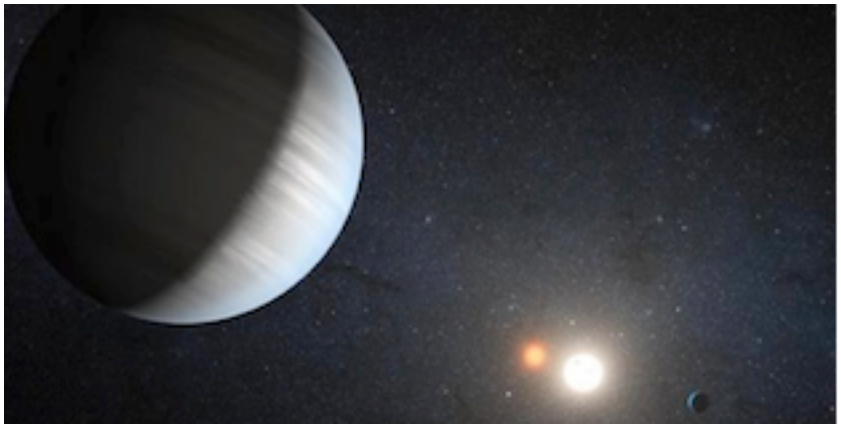
http://www.space.com/17336-**tatooine-alien-planets-two-suns-solar-system.**html

Report and Speculation By Peter Kokh

"**Tatooine**" – a fictional planet and setting for many key scenes in the **Star Wars** saga. It orbited a "close binary" star system with G-type and K-type twin stars – http://en.wikipedia.org/wiki/Tatooine – By the way, the name Tatooine comes from the Tunisian community of homes dug into the surface named Tataouine where the opening scenes of the film were shot. http://en.wikipedia.org/wiki/Tataouine

A scene on Tatooine from in first **Star Wars** science fiction film – http://en.wikipedia.org/wiki/Star_Wars

It was an interesting concept, but could close binary stars really share a planetary system? Some astronomers doubted that any kind of binary or multiple star system could have planets. After all, the only planetary system we have known until recently, was our own, around a single star. But in recent years, since we have become able for the first time to detect planets around other stars, we have indeed found planets in binary systems.



Artist's depiction of a planet orbiting the close binary Kepler-47

There seems to be two distinct situations which alone favor the development of stable planetary orbits: The stars form a close pair at the center with planets orbiting their common center of gravity. This is the "Tatooine class." And where the eco-zone, the orbital range within which it is warm enough but also not to cold for liquid water to exist on planets, we have an interesting situation. If we find just one such planet, there must be more.

Other planetary systems and Life

The era in which faith-motivated thinkers could believe that our solar system might be unique in all the universe is long gone. Not only will many, perhaps even most, single stars be suns with planetary systems, but now we know that at least two classes of binary stars are likely to have planetary systems as well.

There was also a time in which faith-motivated thinkers could believe that life was unique and in all the universe, found only on Earth. That space, not only within our system, but interstellar space in general, is pervaded with gas clouds composed of sulfur, phosphorous, oxygen, nitrogen, carbon, and hydrogen, the building block of life, suggests otherwise. And now we know this thin interstellar gas, immixed with inorganic ions, atoms, and molecules, is also peppered with amino acids from which the DNA of all living organism is composed. The only possible conclusion is that life is natural and will arise anywhere and everywhere in this vast universe where conditions are right. Life is still precious! That it will be found throughout the universe does not make it any less so.

Life as we do not know it

Until a few decades ago, we could only conceive of life on "land/sea" "continents/ocean" type worlds such as our own. Then we began to suspect that Europa, whose ice covered surface is very flat, might contain a sub ice-crust ocean below that could contain more water than our own oceans. At the same time, we began to suspect that life did not begin in tidal pools but deep in the ocean where hot water vents percolated the nutrients on which life could originate and evolve. We are a long way from being able to drill through Europa's crust and see for ourselves.

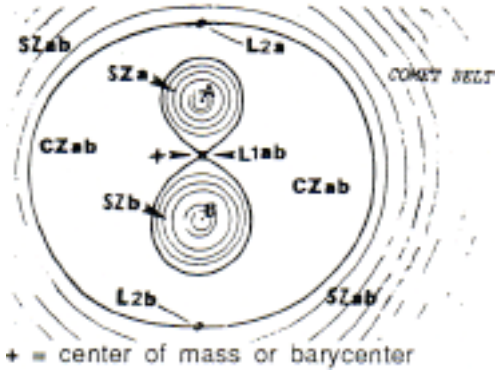
Meanwhile, we now suspect that Europa might not be alone. Ganymede and Callisto around Jupiter and Titan and Enceladus around Saturn may have oceans beneath their ice crusts as well. The key enabling factor is that these icy moons orbit a planet with enough mass to cause tidal heating within these moons. Ice moons with subsurface

oceans might be many times more abundant in the universe than our type of surface land-water planet. That such tidal heating does not depend on how close or far the moon's primary planet is to the system's sun or suns, means "Europids" - if they can give rise to life - must be much more common than Earth-like worlds. Even rogue gas giants or brown dwarfs could have europids. Read :"Europids" pp. 47-49 (originally published in MMM #39) in MMM Classics #3 - http://www.moonsociety.org/publications/mmm_classics/mmmc4_Jan2005.pdf

Widely separated binary systems

Surely, where two stars rotate around a common center of gravity whether in circular or very elliptical orbits at a distance range where an eco-zone could exist, planets would not form in that zone, though they could orbit individual stars close in, or both stars, much further out.

We discussed the case for Alpha Centauri A and B separated by a distance similar to Neptune's from the Sun, in our article "Alpha Centauri" (originally published in MMM #43) pp. 13-15, MMM Classics #5 - http://www.moonsociety.org/publications/mmm_classics/mmmc5_Jul2005.pdf with this graphic (source?)



This graphic shows that in systems like Alpha Centauri A-B, there could be three systems of planets, one close in around each star, and a shared one at a greater distance with orbits in between being unstable.

Now there are trinary systems with 3 suns (actually Alpha Centauri AB has a distant companion star C known as Proximal Centauri) and even more complex systems.

The point is that life-hosting planets and moons are not rare and special but indeed, they are common. The universe as we know it is a planet-friendly one, even a life-friendly one. That said, the chances of finding a system that is close enough to ours that also happens to have a contemporary civilization, in a universe 13 or more billion years old, would be extremely unlikely in general. But the universe is so vast that here and there, there may be neighboring and also contemporary civilizations. We should not presume that we will be lucky enough to have won such a lottery.

But is it not enough to look up at the stars and know that "somewhere and somewhen" - indeed throughout space and time, there must be others looking up into their heavens with similar awe and wonder, whispering, "Hi whoever, wherever, and whenever you are. Isn't it wonderful!"

We whisper back, "yes!"

Relevant reading:

- http://www.space.com/17336-tatooine-alien-planets-two-suns-solar-system.html
- http://www.space.com/17343-tatooine-solar-system-planets-2-suns-gallery.html
- http://www.space.com/17348-tatooine-alien-planets-two-suns-kepler-74-infographic.html
- http://www.space.com/17347-tatooine-like-system-found-two-planets-two-stars-video.html
- http://www.space.com/17376-sharing-the-light-of-two-suns.html
- http://www.space.com/17582-life-survive-strange-alien-planets.html

Note that from time to time, we have had articles in Moon Miners' Manifesto, about what lies beyond our solar system, and why not? As we have noted, Genesis may have it only part right. A more accurate statement might be

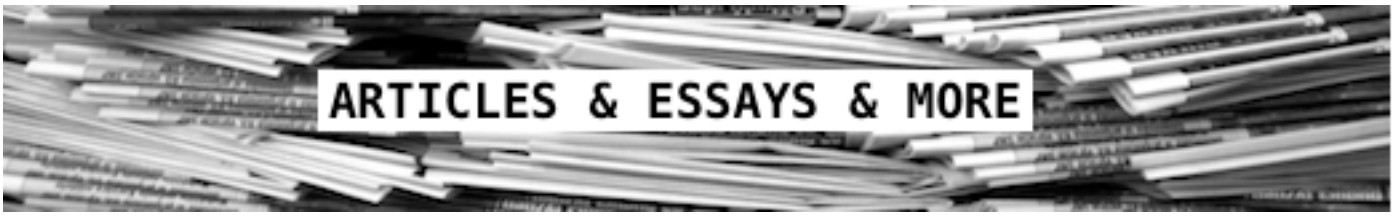
"Of stardust thou art, And to the Stars thou shalt Return!" **PK**

ASTRONOMY + ASTROBIOLOGY NEWS LINKS

http://www.space.com/17392-**seti-alien-search-uwingu-funding.**html
http://www.space.com/17530-**universe-dark-energy-supercomputer-simulation**
http://www.space.com/17549-**dark-energy-real-universe-expansion.html**
http://www.space.com/17609-**alien-planets-sun-like-stars-cluster.**html (the well known "Beehive")
http://www.space.com/17657-**alien-planets-methane-meteorites-atmosphere.**html
http://news.discovery.com/space/**exoplanet-count-jumps-to-over-800**-dnews-nugget-120820.html
http://news.discovery.com/space/**all-of-keplers-exoplanets-orbiting-one-star**-120814.html

Spitzer Finds Possible Exoplanet Smaller Than Earth

http://www.nasa.gov/mission_pages/spitzer/news/spitzer20120718.html >>>



Awards for Entrepeneurial Innovation given at "New Space" Conference in US

Report by Peter Kokh

In most nations, "space-related innovation" is the territory of national space agencies and their contractors. But in the United States, for some time now, there has been a growing "New Space" movement pushed by The Space Frontier Foundation [http://spacefrontier.org/] at the annual New Space conferences held south of San Francisco, California near the NASA AMES center at Moffett Field, CA. "New Space" - http://en.wikipedia.org/wiki/NewSpace - is "an umbrella term for a movement and philosophy ... associated with relatively new aerospace companies working to develop **low-cost access to space or spaceflight technologies**."

The Space Frontier Foundation was organized in 1988 specifically to promote entrepreneurial development of space technologies outside of NASA, its Centers, and its primary contractors. SFF has been the driving force behind innovation by entrepreneurs in the two and a half decades since. SFF was the primary driver behind the effort that led to the Lunar Prospector mission in 1998-9, starting with a special conference in 1989.

http://www.moonsociety.org/publications/mmm_papers/lp_prehistory_paper.htm

At the Awards GALA dinner, six different awards were given for entrepreneurial innovation in various fields related to space. http://newspace.spacefrontier.org/Gala/ - This year the award for the "best New Space Business Plan" went to **Space Ground Amalgam** [http://spacegroundamalgam.com/] http://spacefrontier.org/2012/07/space-ground-amalgam-wins-competition/ The company has locations in Montana and Colorado and provides **inflatable satellite reflector components to meet and increase higher industry bandwidth demands, while reducing launch costs and increasing design flexibility.** Their technology can **also be used for booms and solar arrays.** The founders are Rick Sanford, Michael Potter, Chris Stott, Dr. Raz Itzhaki Tamir and Daniel Rockberger. They are seeking further funding of $3.5M and their market consists of satellite companies for HDTV, Mobile TV, high-speed Internet, bi-directional cellular, NASA, GPS, military, industry and academia.

Last year's winner was Jonathan Goff of Altius Space Machines [http://blog.altius-space.com/] Louisville, Colorado, near Boulder and the University of Colorado.

Jonathan had first caught our attention ten years ago as a student at Brigham Young University in Provo, Utah when he organized the Utah chapter of the Moon Society, then the Brigham Young University Moon Society Student Chapter. After graduation he joined Masten Space Systems {http://masten-space.com/} in Mohave, CA (a hot bed concentration of "New Space" startup corporations) but eventually left to form his own company. At New Space 2011, Goff and Altius were awarded to

You can watch a video of Jonathan's winning presentation at:
http://blog.altius-space.com/2011/08/biz-plan-pitch-video/

You can read about Altius' "**Direct 2 Station**" (**D2S**) Deliveries Program at:
http://blog.altius-space.com/2011/08/direct-to-station-d2s-deliveries-system/

The M3IQ editors would like to see the "New Space" movement and philosophy take root in other countries where private enterprise is valued. Europe (ESA) and India are ripe for this type of **entrepreneurial research and innovation**. The ultimate goal is to be able **to do more in space with less money through ingenious new approaches.** This is an area that opens vast horizons for students and young people ready to try new things.
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Mission to Planet Earth

By Peter Kokh

We are launching this publication with the realization that there is a duality about our space activities. "Space is a Mirror inward to better understand and manage our home world, and also a "Window and Door" outward to better understand our planet's birth nest, the Solar System, and our sister planets and moons.

Space as a Mirror

Many of our satellites in various Earth orbits are dedicated to better understanding of the planet we live on, and to better management of our services. Weather satellites, Remote Sensing Satellites have become integrated with our daily lives as well as with short and long term decision making. Communications and Television-to-home relay satellites are essential to daily living. The total economic value of Low Earth Orbit - LEO - and Geosynchronous Earth Orbit - GEO satellite operations is now well over $250 billion dollars (E194 billion Euros) and climbing swiftly.

Space as a Window

For the major space powers, United States, Russia, India, China, Japan, and Europe - their crowning achievements in space involve Missions to the Moon, Mars, Venus, Mercury, Asteroids, Jupiter, Saturn, Uranus, Neptune, Pluto and beyond - not to forget the Sun itself.

Back to the Mirror

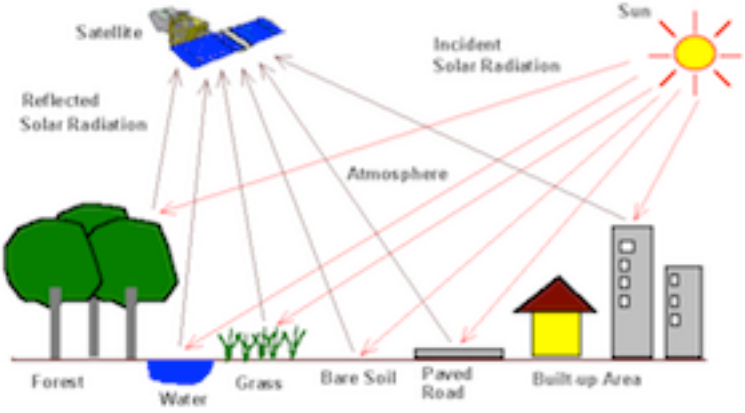
But even for these major space powers, Earth itself remains the primary object of our study. From the vantage point of Earth Orbit, and with the assistance of specially tuned instruments, we can study Earth as never before, learning much that would be more difficult to learn from down on the surface itself.

We are talking about the wide family of remote-sensing satellites. Their instruments are designed to isolate and study in detail many things: forest cover and deforestation and desertification, growth or shrinkage of ice sheets, ocean surface temperatures, land use patterns, ozone buildup, and much much more.

For most other countries, exploration of "outer space" is not a financial feasible prospect. In Europe, however, many smaller nations pool their efforts and resources under the European Space Agency, to explore the Moon, Mars, asteroids, the Sun, etc. This is a very successful collaboration that nations in other parts of the world would do well to emulate. There are movements in both Africa and South America to do something similar.

Make no mistake, however, student and adults alike in smaller nations are just as interested in "outer space" as citizens in the major space faring countries. That there are a number of Google Lunar X-Prize contenders in some smaller nations is ample testimony to that. Bulgaria, one of these, contributed an instrument to India's Chandrayaan-1 probe. So clearly, there are avenues where smaller nations who must budget carefully, can still play a role. Generally, information is shared with nations covered in the various data sweeps by remote sensing satellites flown by the bigger space agencies.

But "Mission to Planet Earth" - studying our own home planet from the vantage of space, whether by individual satellites or from the International Space Station is vital, as well as a powerful economic tool for nations around the world to plane management of their own resources. Just one of many many examples below.



Above Left: This ALOS satellite image shows an area with extensive agricultural use in western Russia, with roads and rivers cutting through the cropland, part of Russia's Black Earth Region, is about 400 km south of Moscow. http://www.space.com/17531-earth-from-space-chernozem-cropland.html

Above Right: Diagram of elements involved

Links: http://en.wikipedia.org/wiki/Remote_sensing_(archaeology)#Location_of_ancient_Iram

http://en.wikipedia.org/wiki/Remote_sensing - http://en.wikipedia.org/wiki/Remote_sensing_application

http://scioly.org/wiki/Remote_Sensing - http://www.sciencedirect.com/science/article/pii/S0924271609000884

http://www.isro.org/isrocentres/rrssc.aspx - http://landsat.gsfc.nasa.gov/education/tutorials.html

http://www.jaxa.jp/about/centers/eoc/index_e.html - http://www.crisp.nus.edu.sg/ >>>

On the Death of Neil Armstrong, First Man to Step Foot on the Moon




Neil Armstrong, an Apollo Hero: Personal Recollections by a Penny Pincher

By Dave Dunlop, August 29, 2012

Paul Harvey's Den, July 1969

Like so many people around the world, I watched **Neil Armstrong** set foot on the Moon live on television. I was in my early twenties and in the home of Paul Harvey, a prominent American radio news commentator, whose son was my best friend from high school. We were sitting on the floor of their den "glued" to the TV. After a while we watched Buzz Aldrin also descend from the Lunar Excursion Module and watched pictures of both men on the surface of the Moon. Those ghostly black and white TV images transfixed us and everyone who saw them at that moment.

Neil Armstrong, who became an instant world hero however retreated from the pressure of global fame to an "ordinary life" as a professor of engineering in Cincinnati, Ohio. He also became "famous" for his reluctance to do public presentations or to celebrate his celebrity. When he did, it was on rare occasions over the years, often in some official celebration connected with the US Government.

Oshkosh AirVenture Air Show, Oshkosh, Wisconsin, July 1989

I live in Green Bay, Wisconsin some 60 miles from Oshkosh, Wisconsin which is the home of the Experimental Aircraft Association. The EAA holds a huge world class aircraft show, AirVenture, during late July every year. About twenty years ago I learned that Neil Armstrong was making a rare appearance at this (then called) EAA fly-in, perhaps because before he was "the astronaut," he was one of the elite pilots of experimental aircraft. He was speaking to a large crowd in an open air auditorium. The crowd that came to see him could not fit under the roof but spilled out onto the grass surrounding the building that July evening.

He spoke about the Apollo program without pretension and gave a straightforward account of his experiences. After his speech he generously remained up on the platform and answered questions from those coming to the front. I was among them and was delighted to be able to approach him and ask him, "If you had the opportunity to go back to the Moon would you? He smiled at me and said, " I'd do it in a heartbeat if you buy the ticket."

Moon Geologist, Dr. Harrison (Jack) Schmidt

About four years ago I also had the privilege of listening to astronaut Dr. Harrison (Jack) Schmidt, of Apollo 17 fame, speak in Houston, Texas. (1) He was the only physics scientist (A PhD in geology) among the Apollo astronauts, and subsequently he went on to become a US Senator from the State of New Mexico. He said that at one time he had calculated that if one took the entire Apollo program budget (about $110 Billion) and divided it by the number of minutes the 12 astronauts who landed on the Moon collectively spent there, that the cost per minute would roughly be a million dollars a minute.

I then more fully appreciated why Neil Armstrong had that smile when he said to me "I'd do it in a heartbeat if you buy the ticket." That price point (a million dollars a minute) also perhaps best explains in a practical sense why no one has returned to the Moon in over 40 years. Any national leader must ask those advocates of space exploration and operations, "What are you going to do for the country that is worth a million dollars a minute?"

The National Treasure of Space

In the fever of "the cold war" it was worth the treasure to engage in a peaceful combat with the Soviet Union (Russia and 15 other captive republics) in a race to demonstrate national superiority as well as face the risks of engineering failure in the vacuum and cold of space and with the additional risk of radiation events from solar flares or potential coronal mass ejections. Why was it worth it? Let us not forget that those in charge in both the US and the Soviet Union at that time had fought the desperate battles of WWII. They had seen friends die and witnessed the terrible willful destruction of war. Both Kennedy and Nikita Khrushchev were hardened veterans of that conflict. Neil Armstrong had also flown in combat in the Korean war. Today, we look at Apollo, not as just an incredible engineering stunt, which it was, but also as a mission which began to unlock the secrets of our companion planet the Moon. Because of the understanding gained since the Apollo Program not only of the Moon, but of the Earth and its limitations, and of material science, and our economic models we have a much better grasp of "the stakes" financially of our space program.

If we are emotionally honest about the Apollo Program, "we" the US, mostly went to the Moon to demonstrate that we could "beat" the Soviets with our teamwork and our technology. If it were not for that almost no one would, in the political system at that time, have been taken seriously if they had proposed to spend 110 Billion dollars to get "a few boxes of rocks" from the Moon.

The justifications that this was about science were made of the thinnest tissue to “dress up” the fact that so much money and effort was being spent. This was a type of social psychological mobilization of American society for the cold war.

In retrospect it shows how tragically shallow and immature that humanity is that “the sport of war” psychologically would lead to such an enormous effort by both the US and the Soviet Union. In the aftermath of WWII when so much had been destroyed and so many killed, and when there was also so much to be done to alleviate suffering and misery, and disease, was this really the best that we could do? But as “shallow” as that was it was infinitely better to have spent that fortune in a “cold war” race to the Moon than in a hot one with the Soviet Union.

That was the real choice for President Kennedy as the US political leader in the aftermath of the Cuban missile crisis and the American fiasco of the failed Bay of Pigs military invasion attempt. I can surely understand that Neil Armstrong as a veteran of 78 combat missions also felt it was worth it to risk his life in a peaceful competition and journey to the Moon and back.

But risking one's life is one thing! For most penny pinching cheapskates wasting a fortune in other peoples money is another! On the face of it many even today would say: “There is nothing practically useful that can be done at a price of a million dollars of minute that can really justify sending astronauts back to the Moon.” The citizens of Neil's home town of Wapakoneta, Ohio did not apparently feel that way when they built a wonderful museum to their native son. NASA apparently did not feel that way when they provided Neil's personal T-38 jet trainer which now graces the entry boulevard entrance to Neil's museum there.

For example, The Planetary Society, founded by Carl Sagan and Louis Friedman, and run by the later for many years, has opposed the focus on manned systems in space when robots can do the job at much less expense. Well, they have a point, which the Soviets also made during the competition of the Apollo era. After a couple of terrible explosions of their monster N-1 rocket, (with a large associated loss of life in one instance which was kept a secret from the world public), they refocused their efforts on a robotic exploration of the Moon. Three times they sent Lunokhod rovers to the lunar surface and then returned with samples of that surface. The last time was in 1976. That is something the United States did not do during that competition and has not done yet. That was also a triumph of robotic engineering in its own right. We have just seen the recent celebration of the landing of **Curiosity**, the largest robotic lander to date on Mars. I attended a wonderful party that night at the Museum of Fight in Seattle that celebrated a feat that also resulted in well deserved cheers and tears of triumph and that I also celebrate as an extension of the spirit of Neil Armstrong.

To their credit, both the Soviet Union and the US followed up their stupendous competition of a human adventure to the Moon with continued robotic exploration initiatives to Mars and elsewhere. Indeed those “boxes of rocks” have opened up the understanding of our co-planet Moon. We have pushed out to gain the understanding of Mars, the next challenging planet, and a much more detailed understanding of the asteroids and the solar system at large. The Science Mission Directorate of NASA can be vastly proud of its robotic achievements as can the other national space faring agencies that have joined this exploration. They are also an extension of Neil Armstrong’s sprit.

Curiosity Knows No Bounds

To those who say manned space activities are “a waste” (of financial resources) I say they reflect a taste for adventure, a taste of the exotic and the risky, a basic yearning to go beyond existing limits, and an exercise of man's unique capabilities for observations and problem solving. It is arguable that 'Linnaeus' (The Swedish doctor/ taxonomist Carl Nilsson Linnaeus) naming of our species “homo sapiens,” which could be loosely translated from the Latin as “the smart monkeys” or worse “the wise monkeys,” is a self-pretentious fraud as an act of naming. He would however had been“dead on accurate” if he had named us “the curious monkeys.” Our latest Martian robot Curiosity is aptly named, at least as a psychological mirror of humanity but I doubt anyone would claim that it had Neil Armstrong's courage in those last terrifying before his successful landing. The cool courage of the engineering team remained behind at JPL mission control consoles for Curiosity's “seven minutes of terror.”

To skeptics of the value of manned space flight I would contend if that is true then our International Space Station reflects the “the wastefulness” of a collection of fools”, (the 16 countries that were mortal enemies in WWII and that cooperated and planned and built that station over some twenty years of effort). That too is about curiosity and the ability to learn how to sustain human presence in space but also about the wisdom of human cooperation. Those like the Planetary Society who denigrate manned space flight and prefer only robotics are to me at least mere penny pinchers. We, the curious monkeys, do not want to be just bystanders to robots. We wish to directly exert our own powers of observation, acquisition, and intuition. Personal engagement is worth a lot to our species. One study on the International Space Station has placed the cost of an astronaut per day on ISS at about $7.5 million dollars a day in 2010 dollars. (2) This compares favorably with the estimated cost of $19.6 Million dollars per day on Skylab, the direct descendant space station of the Apollo Architecture. If I can work my calculator competently (often questionable) I come up with a cost of $ 5,208 dollars a minute for the ISS and $13,611 per minute for Skylab.

The reason I am a member of the National Space Society (NSS) and the Moon Society (an affiliated organization of NSS) is because I believe in the future of the presence of humanity in space on both the Moon and Mars and elsewhere. I believe in the application and use of space resources to both protect and preserve the Earth and its environment and its many species.

I believe that the use of space resources will enable the Curious Monkeys and their co-dependent species to both explore and settle in other destinations in our solar system and beyond. I also believe that this can be done cost efficiently. The benefits of these efforts can transform our vulnerable planet Earth into a better place where humanity can live in a more benign balance with other species than at present with our limited resources. I am sure that our space engineer hero Neil Armstrong also shared those beliefs in his dedication of Purdue University's new space engineering building..

I have to count myself among those who are skeptical of the cost-benefit ratios of a million dollars a minute for human presence in space. But in the NSS and the Moon Society, we believe in a commercial model and much improved cost efficiency in both explorations and space operations.

We support collective government efforts where pioneering exploration demands collective government expenditures that could never be justified by proprietary enterprise. Expenditures of those magnitudes cannot be justified by a private business model that demands timely returns on investments for the investors. In forty-some years we have gone from a million dollars a minute in Apollo on the Moon to $5,208 dollars a minute on the ISS. That would still yet be "One small minute for Dave, One Giant Withdrawal from my bank account."

Opening The Frontier of Falling Price Points

Of course Neil Armstrong knew what he was doing when he asked me to buy his ticket back to the Moon. The cost frontier of space is one of the next barriers to overcome. The price points are dropping and a number of companies are gambling that enough tourists can really afford trips to space. Virgin Galactic has advertised that the cost of a suborbital flight over 100 kilometers into space on SpaceShip Two is $200,000 (E 155 Euros) or about a 30 minute flight. That is $ 6,666 (E5,158 Euros) per minute. Other competitors in that market for suborbital tourists hope to charge perhaps half that figure or $ 3,333 per minute. In "a mature" well competed suborbital market some have speculated perhaps the costs can be driven down to $50,000 per trip or $1,666 per minute if the flight is 30 minutes. With progress like that perhaps in another twenty years I might have afforded Neil's ticket!

Robotic Missions of exploration are being planned that use the new low-cost, low-mass paradigm of cube-satellite scale construction and instrumentation to reduce the cost of new missions of exploration beyond LEO from hundreds of millions to a price point perhaps now approaching single digit millions.

Neil would have liked that.

I believe that we will see a continuing drop in the price of manned operations as the development of reusable launching technology advances. Companies such as Space-X hope to succeed in demonstrating this possibility. And companies like Bigelow and Excalibur Almaz hope to reduce the cost of building and manning space stations twice the pressurized space of the ISS for perhaps an order of magnitude lower cost. Neil would **really** have liked that!

Opening The Frontier of Space Resource Utilization

The greatest economic opportunity facing humanity at present is the potential of changing the dominant energy supply of humanity from fossil fuels to "clean energy resources". We can do that on a global scale by direct dependence on the sun via solar power satellites. That is an achievable goal within 20 to 30 years with the current technology in hand. (3) Alternatively we might derive clean power from the mastering of a sustainable fusion reaction which is beyond the state of the art at present, but the Moon could be a source of fusion fuel when sustainable fusion is achieved. Armstrong knew that.

We can also produce rocket fuel from frozen lunar volatiles, lunar minerals, and asteroidal materials. That is the potential return on that "obscene investment" in those boxes of rocks. The investment of hundreds of billions that we have made in the space program during Apollo and afterwards to the present can yield within the lifetimes of children now in school trillions of dollars of value annually as a power source for global civilization. It will avoid trillions more in costs by saving environmental destruction and species extinctions. It will be worth more trillions in the desalinization of ocean water and pumping it to where it is needed. It can perhaps eliminate trillions wasted in competition for earthly resources via wars, and much more. In that light the investments of Apollo and since are rather trivial in comparison to the benefits within our grasp. That is what was opened for humanity when Armstrong, Aldrin, and the other Apollo heroes walked on the Moon. Armstrong also knew that and wanted to go back.

Neil Armstrong Knew It

Eighty-two-year-old Neil Armstrong, our now departed hero, the canny space engineering professor and hot-shot pilot, knew what he was saying when he framed his answer to the question of an average citizen challenging him to go back to the Moon. He was keenly aware of the cost barriers of going back to the lunar frontier. He was a pioneer explorer and a test pilot who was far more than a daredevil just doing unthinkable exploration and taking unthinkable risks. He was the consummate engineering professional who knew the stakes and the path forward. He was the real deal, a man whose cool courage, confidence, and intellect will shine for the ages.

References:

(1) Personal experience attending a lecture of Harrison at the Space Museum in Clear Lake Texas, near the entrance to Johnson Space Center on NASA Road One.

(2) Lafleur, Claude (8 March 2012) "Costs of US piloted programs" The Space Review cited in Wikipedia, the free Encyclopedia in their article on the International Space Station.

(3) International Academy of Astronautics Study of Space Solar Power, John Mankins editor, 2011. **DD**

Neil Armstrong: Ultimately, his Legacy is up to us!

By Peter Kokh

In the news recently, someone noted that no human being born since 1935 has set foot on another world. We have frozen out generations of young people from following the Apollo Overture. There are many reasons, but the first and most foremost reason is rooted in the very announcement of the Apollo Program way back in 1961. First, as we noted in our In Focus editorial in MMM #238, September 2010: "**In This Decade,**" – three little words that won us the Moon Race but that have hamstrung us ever since" – **in order to win, we built an unsustainable space architecture, good for a few short sorties, nothing else.** We overawed even ourselves. The result is that we have six sites on the Moon at which Apollo mission equipment was left behind, including the LEM landing platforms, flags, foot prints and rover tracks, and assorted equipment that was left behind to reduce weight for takeoff back to Earth.

http://history.nasa.gov/moondec.html – http://er.jsc.nasa.gov/seh/ricetalk.htm

We agree with the ideas expressed in the following recent web article:

http://www.space.com/17330-**neil-armstrong-death-moon-landing-site-preservation**.html

> "The passing of famed astronaut Neil Armstrong, the first man to walk on the moon and commander of Apollo 11, may strengthen the movement to designate the Tranquility Base lunar landing site as a National Historic Landmark. The field of space heritage preservation is gaining momentum, and a recently authored bill aims protect the Apollo 11's Eagle lunar lander touchdown site and all the artifacts that astronauts Neil Armstrong and Buzz Aldrin left behind on the lunar surface."

Related Articles:

http://www.csmonitor.com/Science/2012/0829/Should-the-Apollo-moon-landing-site-be-a-National-Historic-Landmark

http://lunarscience.nasa.gov/articles/nasa-sets-guidelines-apollo-moon-landing-sites/

http://news.discovery.com/space/nasa-will-preserve-apollo-landing-sites-120528.html

http://www.washingtonpost.com/opinions/stepping-lightly-on-the-moon-anticipating-tourists-researchers-want-to-preserve-apollo-11-sites/2012/07/17/gJQA4Jn2rW_story.html

http://cosmiclog.nbcnews.com/_news/2012/05/29/11943652-rocketeers-obey-nasa-moon-rules?lite (short video)

> **It is important that we go beyond NASA rules and regulations, and draft an internationally applicable document that both preserves historic artifacts and allows tourists to view them in a way that minimally disturbs these sites as well as sites where artifacts of other nations lay exposed.**

Why would we need to do this? Obviously, because many of us believe that humans will someday go back to the Moon, this time to dig in and stay, as the first "Lunans." And there will be tourists, not only from the ranks of the first pioneers and those to follow, but also from Earth on short "bucket list" trips of a lifetime.

The present movement seems to focus on the Apollo 11 site, the very first, but some order of protection should be given to the other five sites. Apollo 15 at scenic Hadley Rille with the very first moon buggy rover still on location, and Apollo 17 in the scenic Taurus-Littrow Valley and the site of the very last mission getting equal billing.

This might involve installation of elevated walkways lest the historic bootprints get ground into the dust, and railing off the various artifacts left behind in a "see but can't touch" state of preservation. A small museum – tourist center could be within sight, but safely separate. I have seen a small number of proposals for such "National Historic Monument" preservation, but we do not need to go into details here.

Nearby, there may be a place where tourists could make their own bootprints to be preserved by an electronic 3D scan. Back on Earth a personal bootprint likeness could be "3-D printed" of various materials for a special memento. Add photos of tourists on the walkway with Apollo paraphernalia in the background, Earth overhead.he p

An international design contest to design tourist facilities that allowed people to visit and tour these sites without disturbing them, might help illustrate the possibilities as well as better define the treaty restraints. It would involve the international public in the process.

Why we should enact such a "treaty" as soon as possible – after such a design competition has been held

Once it becomes apparent that humans are going back to the Moon, not just for further exploration, but to lean how to use lunar materials to help build structures in Geosynchronous Earth Orbit (solar power satellites and large platforms that can each host hundreds or more telecommunications and other satellites) at far less cost than shipping all the needed materials up from Earth's surface, then we are going to hear from well-intentioned environmentalists (among whom I count myself) that we should leave the Moon to itself, "hands off!," in its pristine state.

If we enact such a historic site preservation and monument measure, that will help those of us who want to see the Moon developed in a way that preserves its beauty, not only from Earth, but from lunar orbit, and indeed on the surface itself. To this end, we have published a proposal for a Lunar National Parks & Monuments Treaty.

Our proposal appeared as an article "**National Parks on the Moon**" in MMM # **176 June, 2004 p 5**.

reprinted on **pp. 34-35, MMM Classics #18. You can freely download this issue and article at**

http://www.moonsociety.org/publications/mmm_classics/**mmmc18_Jan2008.pdf**

While eulogies of Neal Armstrong are fitting, I can think of nothing better that we can do to honor his memory than to campaign for such an Apollo Historic Sites preservation treaty, as an overture to a broader, more comprehensive treaty on lunar preservation that respects the lunar environment while allowing settlement and scenery-preserving industrialization. As I have remarked before, the precedents set by the current Antarctic Treaty are extreme, and not a model to follow. **PK**

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How extensive is the Apollo 11 landing site?

http://www.theatlantic.com/technology/archive/2012/08/the-apollo-11-landing-site-superimposed-on-a-baseball-diamond/261802/

While the Apollo 11 astronauts spent only a few hours on the Moon and did not stray far, the astronauts on the five successive missions ranged further, and much further once they had the services of the moon buggy, on Apollo Missions 15, 16, and 17. So the standards for protection that might apply to the Apollo 11, 12, and 14 sites, will need to be revisited when considering how best to preserve the later locations, which might draw even greater numbers of tourists and organized excursions.

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In Moon Miners' Manifesto India Quarterly #15, pages 53-54, we published a student proposal about this very topic.

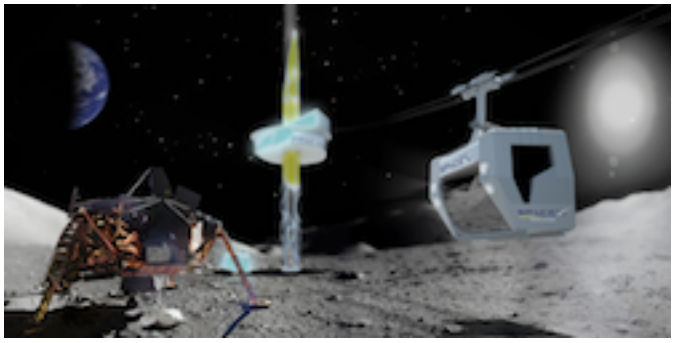
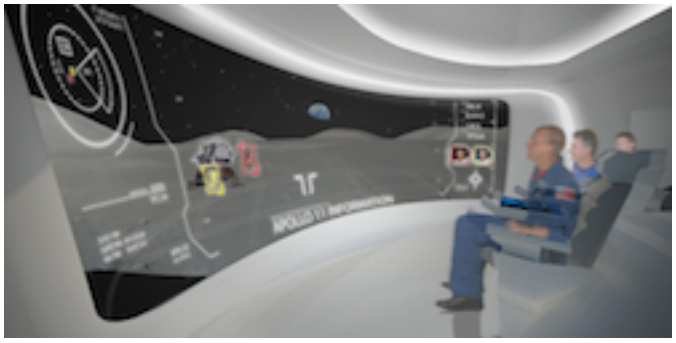
Touring an Apollo Moon Landing Site - A Design Proposal

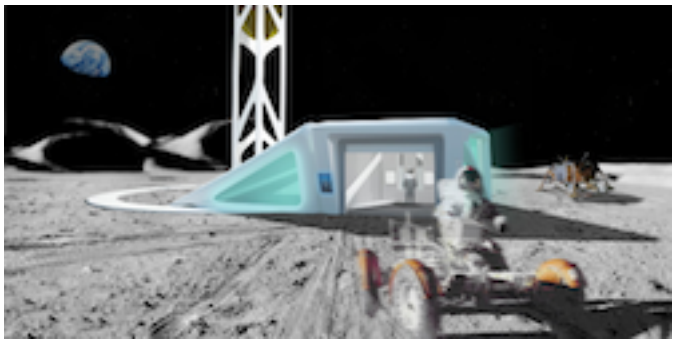
By Frankie Sharpe, student of TTSIQ Co-editor Madhu Thangavelu

To download this issue, simply go to:

http://www.moonsociety.org/india/mmm-india/m3iq15_July2012.pdf

Below are some of the accompanying illustrations

See the full proposal and the above and additional illustrations in original larger size at

http://www.frankiesharpe.com/

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Neil Armstrong Quotes: http://www.brainyquote.com/quotes/authors/n/neil_armstrong.html

"This is one small step for a man, one giant leap for mankind."

"It suddenly struck me that that tiny pea, pretty and blue, was the Earth. I put up my thumb and shut one eye, and my thumb blotted out the planet Earth. I didn't feel like a giant. I felt very, very small."

"Mystery creates wonder and wonder is the basis of man's desire to understand."

"I think we're going to the moon because it's in the nature of the human being to face challenges. It's by the nature of his deep inner soul... we're required to do these things just as salmon swim upstream." >>>

The Many Growth Options in an Evolving Cislunar Economy

By Dave Dunlop

The "bestiary" of the emerging cislunar economy is a melting pot of business ideas and companies, as well as government initiatives, and other advocacy organizations:

Space Advocacy

They reflect the impact of the space advocacy movement which has long preached of a future in which the economic development of space and its human settlement would be transforming to the conditions on Earth as well as the in the spread of humanity beyond the Earth. I list these organizations because they have been a catalyst for both educational and economic thinking and also an element for the evolution of government space initiatives. We encourage our readers to also become advocates and to join those organizations that promote this development, educate the public, and influence both governments and investors. The lunar track that was presented at the International Space Development Conference in Washington D.C. by the NSS and Moon Society focused on the cislunar economy but merely scratched the surface of what is developing.

Listing Space Companies, Project Developments, and Missions

The list I have provided is significant and evidence of the scale of the "movement". I have not attempted to provide an economic total associated with this list but it is conservative to guesstimate that this list represents a multi-billion dollar level of investment annually. Some of these ideas have been around for decades and some seem to have just arrived by stork! The reality of these diverse initiatives reflects the increasing momentum of this economic trend. They reflect different ambitions ranging from transportation related initiatives such as manned capsules, lunar, space stations, additional orbiters, and solar power satellites, and space infrastructure.

They reflect a new vigorous international competition and collaboration in space and especially in cislunar space but increasingly the attempt of private capital to both master the technologies and the market potential of impending commerce. They also reflect the complexity of this newly developing economy which will require both sophisticated robots, telepresence, and direct human presence.

The M3IQ has covered many of these projects in the past and looks forward to their progress in the future. The extensive nature of this list would show skeptics of the future that even in times of economic difficulty there is a vibrant faith in the future of the cislunar space economy that is not limited to just one country or one market development. This is also an area where new jobs will be generated and students planning for careers can look at the skill sets that will be needed when they make their curriculum choices.

Picking Up the Pace

The first decade of this century saw a new blitz of lunar orbiter missions not seen since the 1960s. The second decade will see more than double the cislunar missions of the first including the first private lunar missions. Another notable development is a diversity of transportation initiatives including the new Lunar Cube models at the low mass end, to a range of small landers, to larger supply vehicles like a European cargo lander. This nuanced development is evidence of investor confidence in a variety of market "niches". The foundations are now being laid for a " commercial space economy breakout" in the 2020s and 2030s. The momentum of the 2010s will increase with a rapid increase in the number of launches in the 2020s reflecting both new lower cost launchers and a wider range of missions.

International Momentum

International collaboration will likely result in lunar robotic village initiatives on the lunar surface during the third decade and a developing infrastructure of fuel depots and transportation nodes in both LEO, Lagrange, and even GEO locations as precursors to the likely human return to the lunar surface in the 2020's. It is however the economic roles of using cislunar space as an economic resource for the production of fuels, of transportation infrastructure, of human space tourism, of expanded GEO satellites and ultimately solar power satellites that will be the drivers of growth. The Footprints and Flags strategy of Apollo was an unsustainable model now being superseded by both an international space "race" that reflected a Global Exploration Roadmap approach.(www.globalspaceexploration.org/)

Asteroid Discovery, Assay, and Mining: Planetary Resources Company

(Small low cost spacecraft launched as secondary payloads)

http://www.planetaryresources.com/ - http://en.wikipedia.org/wiki/Planetary_Resources

Lunar Ice Mining & a Supporting Platform of Diversified Support Services: Shackleton Energy

http://www.shackletonenergy.com/ - http://en.wikipedia.org/wiki/Shackleton_Energy_Company

In-space fuel depot storage and transfer: NASA Tech Funding: Boeing, Lockheed-Martin

http://en.wikipedia.org/wiki/Propellant_depot

http://www.nasa.gov/mission_pages/station/research/experiments/RRM.html

http://arstechnica.com/science/2012/03/astronauts-at-iss-begin-learning-to-refuel-spacecraft-in-orbit/

http://www.space.com/3644-prototype-satellites-demonstrate-orbit-refueling.html

http://www.spacenews.com/civil/110623-nasa-defends-satellite-refueling-demo.html

Solar Power Satellites:

- **Space Energy** – http://spaceenergy.com/
- **Artemis Innovative Management Solutions** –
  http://www.space.com/15189-solar-power-beaming-satellite.html
- **Soleren** – http://phys.org/news159020477.html
  http://www.msnbc.msn.com/id/30198977/ns/technology_and_science-space/t/pge-makes-deal-space-solar-power/#.UFCiO1F5nzI
- **SunSat Energy** – http://spacejournal.ohio.edu/issue16/preble.html
- **JAXA Tech Program** –
  http://www.popsci.com/scitech/article/2009-09/japan-wants-power-300000-homes-wireless-power-space
  http://www.telegraph.co.uk/science/space/8277780/Japanese-scientists-seek-to-harness-solar-power-in-space.html
- **CNSA Tech Program** – http://spacejournal.ohio.edu/issue16/ji.html
  http://www.spaceenergy.com/announcements/chinese-academy-of-sciences-continues-r-d-into-commercialisation-of-solar-satellites

GEO Satellite Servicing & Refueling

INTEL – http://www.milsatmagazine.com/cgi-bin/display_article.cgi?number=152118614
MDA – http://www.spacesafetymagazine.com/2012/01/20/mda-intelsat-cancel-on-orbit-servicing-deal/

Space Tourism

Space Adventures – http://www.spaceadventures.com/
Zero-G – http://www.spaceadventures.com/index.cfm?fuseaction=Zero_Gravity_Flights.welcome
SubOrbital – http://www.spaceadventures.com/index.cfm?fuseaction=suborbital.welcome
Orbital – http://www.spaceadventures.com/index.cfm?fuseaction=orbital.welcome
Lunar – http://www.spaceadventures.com/index.cfm?fuseaction=Lunar.welcome
Virgin Galactic – http://www.virgingalactic.com/
X-COR Lynx – http://www.xcor.com/products/vehicles/lynx_suborbital.html
Blue Origins – http://www.blueorigin.com/ – http://en.wikipedia.org/wiki/Blue_Origin
http://www.space.com/2587-tourism-update-jeff-bezos-spaceship-plans-revealed.html
Excalibur Almaz – http://www.space.com/16367-private-moon-missions-excalibur-almaz.html
http://www.dailymail.co.uk/sciencetech/article-2161646/Excalibur-Almaz-prepares-tourist-trips-moon-500k-mile-round-trip-cost-100m.html

New Manned Capsules

Orion – NASA (2022) – http://www.nasa.gov/mission_pages/constellation/orion/index.html
http://en.wikipedia.org/wiki/Orion_(spacecraft)
Dragon (Space-X) in development) – http://www.space.com/15615-spacex-dragon-capsule-crew-mockup.html
http://en.wikipedia.org/wiki/Dragon_(spacecraft)
http://www.space.com/15429-spacex-dragon-space-capsule-manned-infographic.html
CST-100 Boeing (2015?) – http://en.wikipedia.org/wiki/CST-100
http://www.space.com/15363-boeing-space-capsule-cst-100-infographic.html
ATK Liberty Capsule – http://www.spaceflightnow.com/news/n1205/09liberty/
http://www.flightglobal.com/news/articles/atk-announces-capsule-for-liberty-launch-vehicle-371644/
http://www.space.com/15626-iberty-rocket-private-space-taxi-photos-atk.html
"**Soyuz Next Gen**" – 6 person, Roscosmos (in development 2020?)
http://en.wikipedia.org/wiki/Prospective_Piloted_Transport_System – http://en.wikipedia.org/wiki/CSTS
ISRO manned capsule (India) in development (2016?) – http://en.wikipedia.org/wiki/ISRO_Orbital_Vehicle
http://en.wikipedia.org/wiki/Indian_human_spaceflight_programme
http://www.space.com/5967-designs-india-manned-spaceship-revealed.html

New Man-rated Vehicles:

Dream Chaser - Sierra Nevada (test flight stage) - http://sncspace.com/space_exploration.php
http://www.nasa.gov/offices/c3po/partners/sierranevada/index.html

Falcon 9 - Space-X (flown prototype(e) 2015?) - http://www.spacex.com/falcon9.php
http://en.wikipedia.org/wiki/Falcon_9

Liberty - ATK- http://en.wikipedia.org/wiki/Liberty_(rocket)

Manned HTV - JAXA in development 2025 - http://www.spaceflightnow.com/news/n1202/09jaxa/

Lunar Landers

Google Lunar X-Prize Teams (Overall Scoring, and in 9 categories: Funding, Innovation, Social, Connections, Progress, Feeling, Rover/Hopper, Inspiration, Participation) **http://evadot.com/glxpscorecard/**

(The following are the writer's selection of likely top contenders)

Astrobotics (& commercial) (2015?) - http://www.googlelunarxprize.org/teams/astrobotic

Moon-Express (& commercial) (2015?) - http://www.googlelunarxprize.org/teams/moon-express

Space IL (Team Israel) (Lunar Cube Model) (2015?) - http://www.googlelunarxprize.org/teams/team-spaceil

Other GLXP Teams (20 active, 8 withdrawn) - http://www.googlelunarxprize.org/teams

Lunar Cube - Vermont Tech College with NASA Vermont Space Grant Consortium/ EPSCOR with NASA Goddard/ JPL support (2017?) - http://www.vtspacegrant.org/cubesat_vtproject.php

Open Luna (250kg Lunar lander) (commercial) - http://openluna.org/missions
http://openluna.org/wiki/index.php?title=Lunar_Lander

ISRO Chandrayaan II - Lunar lander/rover (2014-2015) use of Russian Lunar Resurs rover uncertain -
http://www.chandrayaan-i.com/index.php/chandrayaan-2.html - http://en.wikipedia.org/wiki/Chandrayaan-2

CNSA Change'e 3 (2013) - http://news.xinhuanet.com/english/video/2012-07/31/c_131750533.htm
http://en.wikipedia.org/wiki/Chang'e_3

Change'e 4 (backup?) - http://en.wikipedia.org/wiki/Chang'e_4 -

Change'e 5 Sample Return (2017) - http://news.xinhuanet.com/english2010/china/2011-03/02/c_13758065.htm

ESA Moon Lander (2018) - http://www.esa.int/esaCP/SEMUV2KOXDG_index_0.html
http://en.wikipedia.org/wiki/Lunar_Lander_(space_mission) -

JAXA Selene II (2017) - http://www.jspec.jaxa.jp/e/activity/selene2.html -
http://en.wikipedia.org/wiki/SELENE-2

Roscosmos Lunar Resurs (likely to be cancelled) -http://www.russianspaceweb.com/luna_resurs.html

Roscosmos Luna Glob (2014) - http://www.russianspaceweb.com/luna_glob.html
http://en.wikipedia.org/wiki/Luna-Glob

Lunar & Cislunar Orbiters/Impactors: Present & Proposed (US only)

Lunar Reconnaissance Orbiter NASA 2010- ongoing http://lro.gsfc.nasa.gov
http://www.nasa.gov/mission_pages/LRO/main/index.html
http://en.wikipedia.org/wiki/Lunar_Reconnaissance_Orbiter

GRAIL (orbiter) NASA 2012- extended - http://lro.gsfc.nasa.gov
http://en.wikipedia.org/wiki/Gravity_Recovery_and_Interior_Laboratory
http://www.sciencedaily.com/releases/2012/08/120831135012.htm

Artemis IV & V (L1 and L2 Lagrange points orbit respectively) NASA 2011- ongoing
http://www.nasa.gov/mission_pages/artemis/index.html

LADEE NASA 2013 - www.nasa.gov/mission_pages/LADEE/main/ - http://science.nasa.gov/missions/ladee/

Armadillo CubeSat Low Orbit Mission Baylor/UT-Austin 2012 - http://www.uk.amsat.org/7042

Kordylewski Mission Baylor - http://www.baylor.edu/content/services/document.php/124326.pdf
http://en.wikipedia.org/wiki/Kordylewski_cloud
http://www.daviddarling.info/encyclopedia/K/Kordylewski_Clouds.html

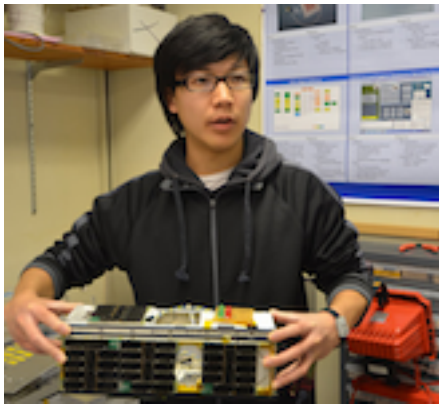
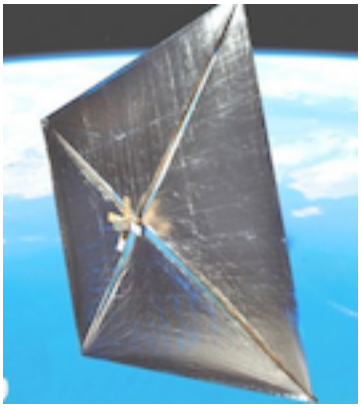
Lunar Swirls impactor UC Santa Cruz (2015?) - http://en.wikipedia.org/wiki/Lunar_Swirls
http://science.nasa.gov/science-news/science-at-nasa/2006/26jun_lunarswirls/
http://www.lpi.usra.edu/meetings/leag2011/pdf/2038.pdf >>>

Abstract: An Affordable Paradigm of Hitchhiker Lunar Cube Spacecraft and Lunar Cube Labs for Exploration and Commerce

Dave Dunlop, National Space Society, and Dr. Rene Laufer, Baylor University

"Hitchhikers Paradigm"

A number of teams of are defining a new paradigm of low cost spacecraft missions which "hitchhike" to their cislunar objectives on larger rockets heading to GEO or a translunar injection trajectory and which use a variety of approaches for affordable exploration. (1). These save considerably on the launch costs of such secondary payload missions. Significantly lower prices can in turn make more frequent cislunar exploration and commercial missions possible. Strictly speaking the hitchhiker paradigm is defined by the secondary payload requirements and technology for large launch vehicles. Their mass range includes Mini-satellite (100kg to 500kg), MicroSatellites 10kg to 100kg), Nanosatellites (1kg to 10kg), PicoSatellites (.1kg to 1 kg).


Small Sat History

In the United Kingdom, the University of Surrey pioneered this Microsat. approach in 1981, subsequently spinning off Surrey Satellite Limited, now a part of EADS. Many universities followed with microsatellite projects during the next twenty years. These spacecraft are also termed "University Class projects" connected to University Engineering and Science programs and small agile teams which include students in the design and construction effort and most often faculty as Project Principal Investigators.(2)

About 12-13 years ago the low cost cube sat architecture and PPOD launch system developed initially at Stanford University and the University of California State University, Santa Luis Obispo and the development of the Small Satellite Workshop Conference at Utah State University influenced many new projects. This Hitchhiker paradigm applied to lunar missions has also been recognized in recent Conference such as the International Astronautical Conference in CapeTown South Africa, 2011. The First Interplanetary CubeSat Conference was held at MIT in May to address the extension of the Cubes Sat architecture to destinations such as the Moon and Mars. Several workshops have also been held on "Lunar Cube" which focus on the application of this architecture to Lunar Missions by Flexure Engine/.˘Æ

Low Cost, Mass, Power and Volume Architecture

This Hitchhiker-Cube Paradigm involves technical challenges of reducing the volume, mass, cost, and range of microdevices instrumentation, as well as short development time line for such satellites. Many cube sat initiatives are not only educational but scientific, military, and commercial. As such it also draws in many additional elements that are part of this design paradigm. Not all projects will include all of the elements listed below and some elements listed are at the edge of technological feasibility. Together these Hitchhikers define a pattern that will reduce the cost of cislunar and Mars operations with a low cost, low mass, low power, low volume architecture and an array of adjunct technology approaches:

1 Utilization of the design standards developed for cube satellites and associated launch systems as secondary "low cost spacecraft mission paradigm < $10M.

2 The development of reusable large booster systems, such the Falcon 9, may drop the cost of launch costs for both primary and secondary missions.

Navigation

3 Utilization of of weak stability boundary navigation and low energy trajectories to define low mass ion propulsion system requirements for mission object

4 Advanced autonomous intelligent navigation, hazard avoidance and landing technologies.

Propulsion

5 Development of micro thruster systems for active spacecraft orientation. (Many cube sat now have a passive gravity gradient orientation)

6 Small ion drive spacecraft propulsion systems that are solar powered. (Thrusters with expensive xenon may be replaced with less expensive propellant)

7 Development of solar sailing technologies

Communications

8 An in-space communication and navigation infrastructure for communication relay in cislunar space. (Small spacecraft with low power and low bandwidth rely on large dishes for Direct communication with Earth or on a relay of weak signals to other spacecraft with more power which may be in Lunar or Mars orbit

9 In space multi-spacecraft neural net communication system.

10 Low cost global web connected small dish low bandwidth tracking networks.

11 Development of an integrated solar array and refractory antenna system (4)

12 Integrated optical communications and proximity sensors (4)

Electronics

13 Ultra low power electronics utilization.

14 Ultra low temperature electronics utilization.

15 Long duration radiation hardened electronics.

16 On board data storage and compression capability.

17 On board data analysis.

18 Micro devices sensors systems constrained by 1 U scale mass,power and volume design standards.* (5)

LEO Testing

19 Spacecraft testing including utilization of LEO test missions and flight qualification in the LEO space environment providing space flight heritage for subsequent selection in deep space missions.

Smart Autonomous Systems

21 Advances in artificial intelligence will enable small labs and space craft to be situationally aware of their environment, to monitor their own performance, to make certain levels of autonomous decisions, and to also process data and analyses result in situ. “Systems on a chip” or “lab on a chip” technologies will make the capabilities of these small craft quite formidable and also provide a capability to obtain analysis of phenomenon that are far distant from Earth observers. Surface navigation across challenging terrains is another pioneering aspects of this paradigm that can results in both more affordable and capable missions.

20 Multi-strand funding development in the United States from NASA OCT, OEMD, AFRL, DARPA, Commercial NASA Space Grant, NASA's Small spacecraft Technology Program. Similar cube sat scale missions are being funded by non-US funded universities around in Europe, Korea, Japan, China, and elsewhere around the world.

Hitchhiker/Lunar Cube Evolutionary Development

Generation 1.0

This generation builds on the design experience and use of commercial off the shelf hardware. NASA or other navigation software is used to define propulsion requirement and to utilize existing chemical propulsion systems to reach cislunar space. The use of LEO cube sats as a means of testing instruments, electronic, and power systems for second generation is a cost effective means of developing space qualified hardware. Convention communications systems are used. and passive gravity gradient orientation is used.

Generation 2.0

Cube satellites designs provide newly developed micro thruster thruster for space craft orientation. Low cost global web-connected communications systems reduce costs of tracking, communications, and missions operations. Low energy trajectories are selected which match mission requirements with the abilities of ion propulsion systems which use xenon gas or alternative less expensive fuels. Integrated solar and reflectory antenna systems are used to increase available power and communications capabilities. Rad hardened electronics are used to meet requirement for long duration mission.

Generation 3.0

Cube sat scale space craft are developed for the cyro-environments in deep space, lunar cold traps, and other cryo-destinations. Ultra low temperature electronic and ultra low power electronic and cryopower systems mature so that these environments are opened to exploration. Optical communications and sensor proximity systems enable coordinated space craft operations. More reliance on on-board processing and data analysis and make these space craft more adaptive. The maturity of these advances in autonomous intelligent navigation, hazard avoidance and landing technologies will allow these small spacecraft to investigate the surfaces of the Moon, Mars, and the asteroids. These later missions may also utilize solar sail propulsion systems for very low mass advanced spacecraft.

Cost Evolution

Hitchhiker "Cube lab" and modular cube scale spacecraft in the microsatellite mass range (2) may grow a significant customer base and a larger volume of lunar missions which can deploy to a variety of cislunar destinations or ultimately to the lunar surface. The Cube Sat architecture has provided mission costs of tens of thousands of dollar to several hundred thousand so dollars to exceptional projects which have cost in the low millions. Nanosatellite Class cube sats will remain a significant training ground for student engagement. Picosatellite scale design may offer a low risk approach to the exploration of challenging surface environments where the deployment of numbers of nanobots may be a cost effective strategy. Mission components may benefit from common design standards but space qualified components increase the costs. A larger market for such mission may also mean some economy of scale in production and purchase of components. Even small scale micro landers with a price point in the low tens of millions of dollars are likely to be demonstrated well before the end of this decade. A these technologies mature, with additional experience and lower mission costs may result in a much wider number of countries and companies that can support these missions. Micro Sat and Lunar Cube lander missions in the $ single digit millions range may become a common place.

Summary

Mission price points in the low tens of millions dollars or even single digit millions are now projected to be within reach for cislunar missions due to the creative use of a variety of approaches enumerated and described above. While not replacing larger scale missions that have been developed in the past this new paradigm will define a new era of affordable exploration missions to many destinations including cryo-destinations in the solar system and of the potential of a commercial market mechanism driving affordable commercial missions in cislunar space and to the surface of the Moon itself.

Notes:

Appendix I

https://sites.google.com/a/slu.edu/swartwout/home/university-class-spacecraft

http://prod.nais.nasa.gov/cgi

http://www.nasa.gov/home/hqnews/2012/aug/HQ_12274_Small_Tech_Demo_Missions.html

http://www.nasa.gof/home/hq

Appendix II

Current Mission Development

As mentioned above the Lunar Cube Model did not arise from an intentional funding program focus but rather from the convergent utilization of diverse technology development drive but cost imperatives. It's reality is based on current mission initiatives as well as research and development technology trends.

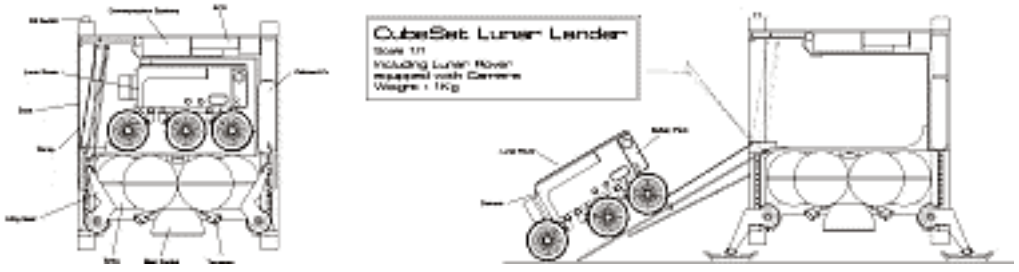
Some current projects include:

1 The **Lunar Swirls Mission** proposed by Principal Investigator Dr. Ian Garrick Bethel would provide two cube scale impactors with magnetometers launched from a mother ship/relay orbiter the size of a washing machine for about $30M. Participating organizations include US Santa Cruz, UC Berkeley, a S Korean University, NASA AMES and the KARI, South Korean Space Agency. Launch might be anticipated in the 2016-17 time frame.

2 The **Google Lunar X-Prize SpaceIS (Team Israel),** lead by Yariv Bash, is developing a 3 U" lunar lander mission as its approach to winning the GLXP by landing on the lunar surface, taking pictures, moving 500 meters and transmitting live imagery of its activities. Its estimated cost range for this project is in the range of $25M to $45M by the December 31, 2015 GLXP prize time line. Participating organizations include the Weizmann Science Institute, Ben Gurion University, The Technion, and the Israeli Defense Industries Association.

3 **A Lunar Cube lunar lander project** is also in development at Vermont Technical College lead by Principal Investigator Dr. Carl Brandon. Project partners include Vermont Space Grant consortium partners U of Vermont, Norwich University, St. Michel's College and assistance from Goddard SFC and JPL. A spacecraft fabrication cost of approximately $1M is projected but no transportation or launch cost are included in this figure. Space Grant and EPSCOR funds have been used thus far. A launch time frame of 2017 is anticipated with continued funding support.

4 **A Kordylewski Dust Cloud Lunar Cube mission** is being planned by Dr. Rene Laufer of the CASPAR Program at Baylor University in Waco, Texas. A precursor CubeSat flight test of the dust/particle detector is scheduled in late 2012 on the Armadillo CubeSat developed by the University of Texas at Austin. The primary mission would be launched as a secondary payload on a commercial satellite launch to GEO. **DD**



A Civilization Risk Assessment and Risk Mitigation Plan cannot be further delayed

By Adriano V. Autino - aa@tdf.it
President of **Space Renaissance International** - http://www.spacerenaissance.org/
[Edited by Walt Putnam and Peter Kokh]

The risks of unsustainable growth

Four years after the beginning of the first global crisis, I believe it could lead directly to an implosion of our civilization. We still have time to revert the process, if the general public underestimation of such global risk could be reversed as soon as possible.

We are seven billion humans on this planet, now 60-70% industrialized. We have both intellectual and material means to put in place a global risk mitigation plan and work it out in sufficient time to prevent a looming implosion of our civilization, and to launch an era of unprecedented economic and cultural growth. So, why we are not moving on that road? What is missing is the perception of the risk, and the persisting fully pre-Copernican metaphysics (perception of the world) bound to the limits of our mother planet.

We at **Space Renaissance International** identified such a general underestimation of the risk, and obsolescence of the world, as the greatest threat to civilization. As Stephen Hawking wisely said, humanity is condemned if it will not expand outside our mother planet, since within the end of this century planet Earth will not be able to sustain more than one billion people.

Recently I was listening on an Italian radio channel (Rai3, a channel devoted to culture and intellectual issues), to an interview with the philosopher Zygmunt Bauman, at a convention on philosophy in Modena, Italy. He was talking about the global problems, the crisis etc... He said that we (civilization) have only two alternatives: (i) to kill some billion people, or (ii) to come to an agreement to deal some sort of "de-growth" path. This concept – de-growth - is currently the most dangerous threat to civilization. None of these self-called philosophers spent ten minutes to analyze what it would mean for a seven billion person civilization to begin forming a degrowth roadmap. It would mean de-science, de-technology, de-culture, and an awful jump back in history.

An Alternative to an unstoppable collapse of civilization

A backwards jump too the Middle Ages? Maybe more, to the Stone Age, since there will be no limits to depression, rising superstition, starvation and barbarianism, once that Pandora's box is opened. However, these people have a great influence, since they claim to be motivated by a moral rationale. Why they don't even consider the expansion of civilization into the Solar System, to take advantage of the great abundance of energy and resources in our solar system, enough for thousand billion people at least, for millennia to come?

There are several answers to this question. Many of these people are simply subject to a kind of bureaucrat in their mind (remember the Robert Pirsig's "mind Joe"?), preventing them from seeing the evidence, since they are not educated to see it. Many simply fear any adventure, and they prefer to die in a known condition than to risk exploring the unknown. Many think that this is a great opportunity to make capitalism finally pay for its sins. But I believe the bigger part of them (both the philosophers and the people who follow them), think that the need to manage scarce resources is an opportunity for the advent of a "new morality," after an age of consumerism and waste. Combine this aim with ecologist beliefs and the result is a powerful antidevelopment (and ultimately anti-human) social vector.

I believe that, down deep, this is the true cause of the current crisis: it is a crisis of philosophy, and we will not come out of it without a complete post-Copernican re-foundation of the general philosophy of our civilization. If that -- the de-growth philosophy -- is the ideological adversary of those who care for the continuation of civilization (and not only of the human species somehow, but of civilization itself) the true humanists don't fight with the sub-cultural means of slander and insults, sadly so common in the current political scene. We will move ahead on the road of scientific rigor. It is time to put in place a serious project, involving all universities and research centers that will manifest their interest. This project was selected by the Space Renaissance International's first Congress, in 2011, but it took until now to put it in the form of a statement of work suitable to be communicated and to be used to call for partnerships and manifestation of interest. We seek partnership by all of the logical stakeholders in this project.

The first basic requirements of the project involve a social analysis. Seven billion humans on one planet have likely already passed the threshold of sustainability of that planet. If we keep growing within a closed system, civilization will implode (as Stephen Hawking so clearly pointed out), and the break-event is expected to occur somewhere in the first half of this century. The main problem is not technological (suitable technologies exist, o r will exist soon) but political, the absence of public awareness of the risk, and of the need for political decisions on a mitigation road-map. Furthermore, the global crisis will reduce the work capacity, the general scientific and technological know-how, and accelerate the process of social implosion. People intuitively know that a big risk is looming, but they don't have a realistic vision of it.

The development of a space economy is a mitigation plan that will oppose and reverse the above social processes and create millions of jobs, in turn restoring hope in the future and stimulating young minds in a positive direction. To win the game, the new risk-reversing industries (such as new space industry) need popular support. Governmental support in the forms of grants, tax discounts, incentives to the new space industry, etc., would accelerate the process and adoption.

In order for the above processes to take place, public awareness of the risks and of the urgent tasks to be undertaken should be raised quickly and systematically.The main stakeholder of this project is the whole human community – in a word, the civilization. Since the civilization risk is tied to all of the species living on planet Earth, the stakeholders includes them as well.

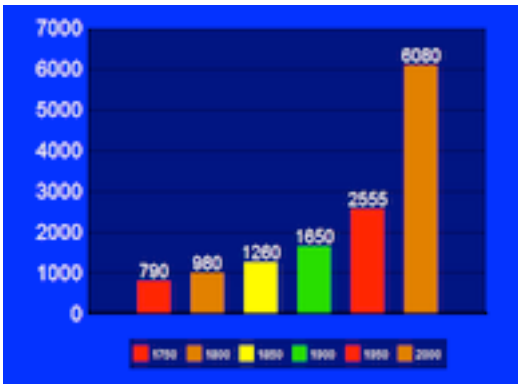
From an evolutionary point of view, being the human species the maximum expression of intelligent life on Earth and possibly in the Solar System, since life in the Solar System can be spread and developed only by an intelligent technological species, the continuation of the civilization is essential to the development of any form of life in the Solar System and beyond. Moving our attention from evolution to society, the young generations hold the major interest in civilization risk mitigation. Therefore all of the institutions dealing with education, student associations, social organizations dedicated to youth, cultural entities, artistic entities, and charity organizations are included within stakeholders as well. Humanitarian international and local associations, such as UNO, UNICEF, Amnesty International and similar organizations, churches, having the help to the Earthling people, enhancement of human rights, safeguard of freedom and democracy in their scope of existence, are part of the stakeholders as well. All of the trade unions, devoted to the defense of the interests of workers and/or entrepreneurs. All of the Earthling governments, devoted to the defense and enhancement of the citizens living conditions. All of the artists and cultural dealers, sensitive to the human living conditions, and all people endowed with a sharp and visionary perception of social changes. All of the enterprises, interested to a growing economy and growing markets. What do we mean with 'civilization risk'? A global risk threatening the existence of civilization as we know it (not necessarily the extinction of human species), or a global risk that could cause that extinction?

A non-exhaustive list of Civilization Risks for analysis and mitigation: progressive dwindling of earthly energy and raw materials sources; the prospect of wars erupting over scarce resources, escalating, perhaps, to nuclear exchanges; asteroid or comet impacting the planet; natural disasters, tsunamis, hurricanes, earthquakes, floods, drought, extreme climate change; environmental decay, either natural or anthropogenic; biological warfare, whether caused by a terrorist strike, a "rogue nation", or a simple accident; evolution of "Superbugs"; cultural decay, resulting in a second "Dark Ages" characterized by superstition, criminalization of science and technology. Each one of these risks can end in a global economic decay, leading to a global crash of the civilization, ruin of all industrial activities, leading to implosion of civilization. Some of them lead to a quick extinction of human life and all living species on Earth.

The goals of the CRAM Project, coherent with mission of the SRI, are to transcend the space community, making accessible to the general public the extreme risks civilization is facing. Identify actual or credible risks with a probability of occurring within the next 50 years. Provide scientific proofs of the probability of the main risks related to our civilization continuation. Provide an awareness of: one or more mitigation plans being necessary and require the urgent attention of political leaders; the need for implementing global projects, targeted to assure the continuation of the civilization and enhance industrial and cultural development; the relationship between global crises and the growth of humanity on its native planet and peoples' empowerment to resist societal decay through cooperative work toward sustainable solutions.

The project also aims to solicit the involvement of universities and research communities, administer a social questionnaire positing the key questions about the future of our civilization, reach interdisciplinary communities, stakeholders of the mitigation plan, which could be directly involved in the realization of the plan itself. The project will seek partnerships with universities and research centers, including those with the following expertise: technical and scientific faculties, sociological and social sciences, philosophy, communication sciences, computer sciences, psychology, political sciences, environmental sciences, architecture and urban planning. A wide parallel development among several working teams will be admitted and encouraged, in order to get forecast and simulation results as much realistic as possible, a strong base for a general mitigation plan.

All people interested to team up please send their manifestation of interest and CVs directly to the author: adriano.autino@tdf.it.

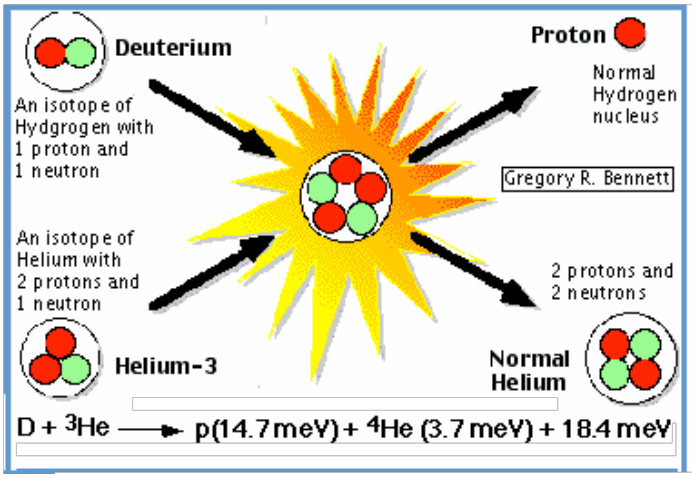


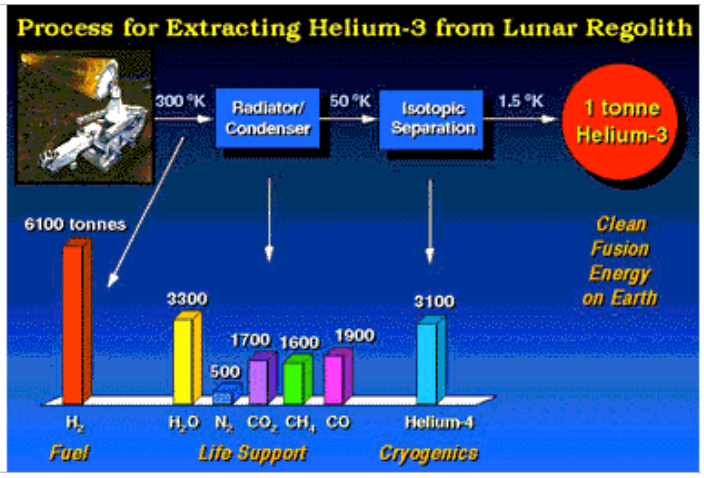
Runaway Population Growth – above at 50 year intervals

China proposes Mining Helium-3 on the Moon for Clean Fusion Power

Report by Peter Kokh

http://inventorspot.com/articles/**chinas_upcoming_moon_mission_seek_out_helium3_fusion_fuel**





Left: the Helium-4 fusion reaction **Right:** by-products of mining He-3 from solar wind volatiles in moondust

Information Resources:

http://www.explainingthefuture.com/helium3.html

http://en.wikipedia.org/wiki/Helium-3

http://ares.jsc.nasa.gov/HumanExplore/Exploration/EXLibrary/docs/ISRU/06Energy.htm

http://io9.com/5908499/could-helium+3-really-solve-earths-energy-problems

http://www.ibtimes.com/articles/171239/20110629/lunar-reconnaissance-orbiter-nasa-moon-apollo-mission-surface.htm

Video on He-3 Fusion - He-3 expert Dr. Gerald Kulcinski - http://www.youtube.com/watch?v=2HeMAXO9OA

A fascinating hour with Gerald Kulcinski - http://www.thespacereview.com/article/536/1

Three Scenarios to use the Moon to solve Earth's long range energy problems

1. **Building solar power satellites with the help of materials produced on the Moon**, is only one of 3 scenarios by which the Moon could play a critical role in providing Earth's burgeoning population with abundant and clean power, reducing our reliance on fossil fuels which are currently pumping CO2 into our atmosphere.
2. **Using lunar materials to build extensive solar panel farms on the Moon itself** and then beaming the power to relay stations in Geosynchronous Earth Orbit is a scenario proposed by David Criswell. Extensive areas at both E and W limbs of the Moon would host these panels, one or the other being in sunlight.
3. **Harvesting the solar wind particles affixed to moondust fines** for Helium-3 is the other. As only 1 out of 4,000 Helium atoms is Helium-3 (instead of the standard He-4) there would be extensive useful byproducts produced in this harvesting project. See graphic above. The He-3 fusion reaction is unique in that it produces no radioactive particles. You could live inside a helium-3 fusion reactor and receive less radiation than most of us receive all the time from radon in Earth's crust.

As exciting and promising as this process seems to be, progress towards achieving nuclear fusion, of any kind, seems to be slow. A common response is "Nuclear Fusion has been 30 years in the future, for the past 30 years." But Gerald Kulcinski begs to differ: We are a thousand times closer to achieving a stable fusion reaction than we were thirty years ago.

Despite a NASA report confirming the potential of He-3 mining, United States government support has been close to nil. The second Bush administration, cancelled all funding for continued fusion research. President George W. Bush and his father President George H. Bush have been heavily involved in the Texas oil industry. There seems to be no support in the US Congress.

Helium-3's future role in allowing all humankind to reach and sustain a prosperous life while helping keep our beautiful planet healthy and green, could be critical. Meanwhile, Japan, a power company in the US State of California, and nor China are backing demonstration projects.

Twenty-some years ago, when total United States power consumption was lower, it would have been true to say that if NASA were to land just one Space Shuttle External Tank on the Moon and fill it with liquid Helium-3, that one shipload could produce all the power the Unites States needs in one year. While we might now need 2 or 3 "ET" tanks full a year, this claim shows the tremendous potential.

In comparison with the other two scenarios above, the He-3 fusion process would not create a ring of bright solar power satellites and/or power relay satellites in Geosynchronous Earth Orbit, forever transforming the night sky. Most SPS power advocates do not realize how much opposition may arise from astronomers, professional and amateur alike. Such opposition could lead to a healthy round of SPS design research to come up with designs that could minimize this problem to some degree.

It would be wise for space enthusiast organizations to sponsor SPS design contests that minimize how bright an SPS unit would appear from Earth's surface, now, while we wait for government support.

Impact on the growth of the Lunar Frontier

Meanwhile, the byproducts of He-3 mining could sustain many thousands of lunar pioneers. The mining process itself is benign and harmless. A harvester would pick up the top layer of moondust, probably less than a meter deep, and after extracting the volatiles with heat, lay that moondust layer back down behind it. This gentile racking of the moondust would not change the appearance of a harvested site except from very close up. The harvester would avoid any crater of size (more than a meter or two wide).

In short, easy top layer sifting in place would do the trick:

√ no landscape scaring,

√ no strip mining,

√ no landscape alteration, and, as frosting on the cake,

√ the bulk of non-He3 volatiles harvested, when separated out, will be an enormous aid towards creating and maintaining settlement mini-biospheres.

Read "**Moon Mining and Common Eco-Sense**" page 60, MMM Classics Vol. 4

http://www.moonsociety.org/publications/mmm_classics/mmmc4_Jan2005.pdf

Two **Helium-3 harvestor concepts**. One at right uses a static mirror to direct sunlight to the miner

Taking the lead

If China does conduct a Helium-3 moon-mining demonstration, that could change prospects significantly. The impact on the future of all of us on Earth could hang in the balance. The attention of short-sighted American politicians seems to be fixed on more mundane and near-term issues, further complicated and misdirected by the flow of money from vested interest fossil energy corporations to the pockets of lawmakers.

So we should all wish the Chinese good fortune in this endeavor. Whether this proposal becomes real or not is up to the Chinese government which may be immune to such bribery. Perhaps this could become an International effort, spearheaded by the Chinese. That would be even more promising, no matter which additional nations become involved.

At the same time, we strongly encourage continued study, research, and demonstrations of solar satellite beaming technologies and other "space energy" alternatives. The more we know, the better the choices we will make.

Now demonstrating the harvesting of Helium-3 from moondust, does not in itself advance fusion research, but it would definitely build more financial and political support for that research. This is a long term effort and will take two or three decades at the least. The prospect of getting started soon should excite all of us. **PK**

Moon and Mars Outposts: Building Shelter Structures First

By Peter Kokh

Apollo left no occupyable structure on the Moon. There is no 'friendly' place to return to, no place where we can go and pick up where we left off. We must start over, from scratch, this time with a plan!

We can't "do the Moon" so long as we fear the Night(span)

All six Apollo Moon landing missions were confined to the early/mid-morning "hours" of lunar dayspans. NASA has never attempted to keep astronauts on the Moon for a full dayspan-nightspan cycle, much less for several of them. Given that deliberate "toe-in-the-water self-limitation, the new rounds of astronauts only being on the Moon for less than two weeks before coming home, there is no urgent need to provide shielding.

However, for longer missions, as essential as shielding is for radiation protection, it will also be essential for thermal management in the month ("sunth") long temperature cycle from 200° plus above zero to 200° plus below zero. Now, choosing polar sites or sites at high latitudes, north or south, would mitigate the problem. But consider an alien species visiting Earth and choosing a Pacific Island where the temperature varied very little over the year, radioing home, "we have mastered living on Earth." Yes the polar sites offer access to water ice, yes they are more thermally benign, yes there is less difference between nightspan and dayspan, but the poles are anything but characteristic of the Moon at large, and do not offer critical access to mineral resources found only in the Maria, or along Highland/Mare "coasts" which means limiting ourselves to parts of the Moon we can explore, but more importantly, limiting ourselves to what lunar resources we can develop to fuel the Earth-Moon Cis-Lunar Economy.

The Two Faces of Shelter

The key is providing shelter, not only from cosmic and solar radiation over extended stays, but also to provide thermal moderation at comfortable temperatures. We would want to "shelter" our living spaces to provide moderate temperatures without energy-intensive heating and cooling even if there were no such thing as solar flares, coronal mass ejections, and cosmic radiation!

How to Shield

Considering the source of the author's original "eureka" moment in May of 1985 (read: http://www.moonsociety.org/chapters/milwaukee/mmm/mmm_1.html) it is natural that I have long visualized an ever growing complex of interconnected habitat and activity modules and pressurized hallways, and as whole "neighborhoods" emerged, pressurized streets - all individually covered with shielding as they were added.

Exercising due foresight

But, whether we are talking about a one-nation effort or about an International Lunar Research Park for the first "permanent" outpost, **it is likely that we will want to rearrange modules and hallways etc. as the complex slowly grows** and as experience suggests more favorable layouts. **Watch this time lapse animation video of the construction of the International Space Station, during which several modules were disconnected and repositioned elsewhere. - http://www.youtube.com/watch?v=h8kOAroNNAo**

This is the flexibility that we will need in building a full-function lunar outpost as well. The original plan for expansion may end up being scrapped, and probably more than once. The way McMurdo Station in Antarctica grew to its present size is a case in point. Early expansion plans proved quite inadequate to provide needed expansion not only in the physical complex but in the variety of activities supported.

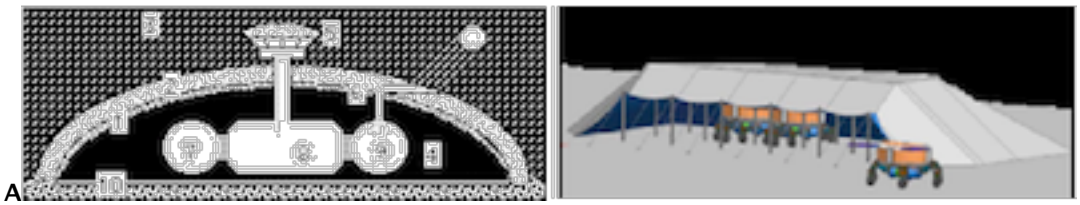
In this light, **it would be best not to start with a few modules**, shielding them as added. For when we wanted to rearrange the complex layout, we would have to remove some of that shielding. Even if we had used sandbags, this would be a chore. There is another way: **Build an expandable shielded canopy first, before delivering modules** to park and interconnect in a temporary arrangement underneath.

Canopies, Hangers, "Ramadas"

A word frequently found in MMM is "ramada." I first learned the word driving through the American southwest in 1980, long before the first MMM. At roadsides where tired drivers can pull in and rest, eat a lunch they brought along, and perhaps use the restrooms, there is often a roof supported by four poles at each corner, its main function being to provide shade from the hot unrelenting sun, rather than shelter from infrequent rains. This shelter is called a "ramada" - Spanish for sun shelter.

Above left: a traditional "ramada" sun-shelter in the SW United States - **Right:** a quonset type shelter

On the Moon, we will probably want unpressurized shelters of various types that are shielded from all directions. That does not mean "closed." Openings through which to bring in modules and other things to be deployed or stored inside can be baffled so that there is no direct path for solar or cosmic radiation to enter.

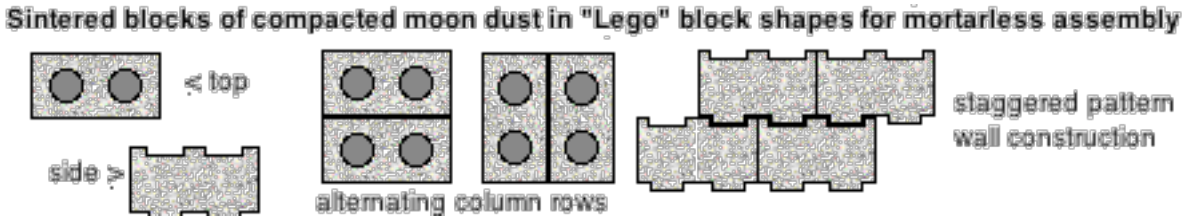


Above left: an illustration from MMM; **Above right:** a similar NASA concept

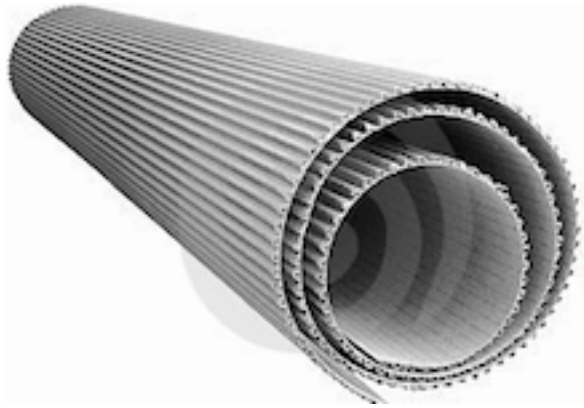
Above left: KEY: (1) Space Frame Arch, Fabric Cover; (2) 20 cm or more regolith dust shielding; (3) exposed vacuum, radiation, micro-meteorites, UV, solar flares; (4) protected lee vacuum service area; (5) observation cupola with ladder shaft to habitat space below (7, 8, 9)

Two ways to deploy such a shelter "first"

1. We can send small crews to the Moon, living inside their lander, and working outside to assemble a suitable shelter. That would take several very expensive missions.
2. Or we can deliver the following package:
   - t**eleoperable equipment** to fabricate useful building elements from moondust, and do some pre-assembly chores including producing sintered **building blocks in the "Lego" design** for self stacking without mortar, producing sand bags (basalt fiber fabrics if the site is in a mare area) and filling them



   - **"intelligent" "avatar" robots** operated by "telepresence" from Earth, to handle some of the harder routine tasks, including leveling the area, assembling support walls from sintered blocks, piling up and bags
   - **cargo container structures designed to be reusable**, for example with an unrollable wall for "roofing." **Keep in mind that there are at least two ways to reuse a rocket stage:** a) **refuel it** for another trip or b) **reuse the materials** of which it is made to help construct things needed at the landing location.



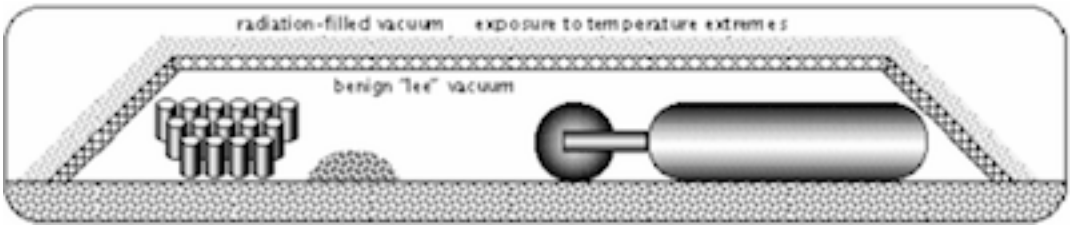
Above: a roll of corrugated cardboard suggests how the **corrugated aluminum skin of a landing cargo stage** (or empty fuel tank) could be reused as a roof to hold blown or bagged moondust, with sintered lego block columns spaced to support the load in1/6 G. If it proved too difficult to manufacture basalt fiber fabrics for bagging moondust to cover a space frame to create roofing, such fabric could be part of the cargo in this shipment.

The corrugation will strengthen this structure in at least one direction. A 2-layer cross-corrugated sheet could not be rolled. But it could be designed to unroll in an arc, short of flat, to provide strong support, the low ends resting on block walls and/or pillars, providing extra internal height.

An option would be two layers of material, placed so that the corrugation of one is at 90° to the other, making a very strong flat roof. (It is cross-grain plies that give plywood its strength and dimensional stability.)

Question: Could Cargo Hold wall unroll into a stable quonset structure? The arched hold wall roof supported in the middle would be stronger than a flat one.supported at the sides. If the corrugated cargo hold wall was designed so that it could not unroll completely but retained a shallow curve, it might be strong enough to hold considerable shielding mass in light lunar gravity.

This type of pre-made reusable roofing, would seem superior, if practical, to constructing a space frame that would then have to be covered with some sort of sheeting (aluminum? basalt-fiber fabric made on the Moon). Both avenues should be pursued to expose and rank all the options.

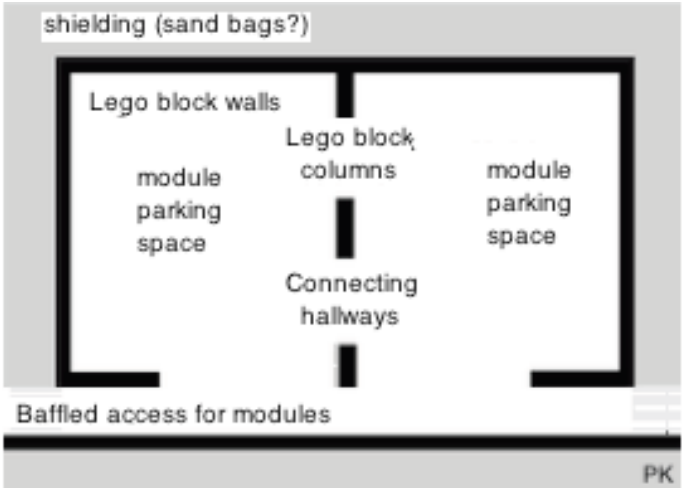


An earlier MMM Illustration: A hangar with "space frame" wall/roof construction requires some type of sheeting to support moondust, Note warehousing area to the right.

The Advantages of pre-constructing a shielded hangar or ramada before first human crews arrive are clear: Each crew could simply park the modules brought along on its mission and connect them. The assembly area would be shielded, and the construction crew could wear lighter "pressure suits." If a following crew brought more modules that required rearrangement of what was already in place, this would be easy, with no contact shielding materials to be removed and then repositioned.

Of course, sintered moondust lego blocks, basalt-fiber sandbags, sandbag filling equipment, and the ramada/hangar itself are not the only job that can be done beforehand. Teleoperable equipment can grade a landing site "spaceport" and compact and sinter the soil, and build berms around the site to contain rocket exhaust-blown moondust, which can be quite abrasive. And of course, the could level the area in which the hangar/ramada is to be built, and build some peripheral roads.

Open warehousing areas can also be pre-constructed, the ground leveled and sintered, the perimeter baffled by berms, sand bag walls, or lego-block walls, for items that can be stored unsheltered. The hangar/ramada should offer a limited amount of sheltered space for storing items best not exposed to extremes of heat and cold, as well as those that needed to be accessed frequently.



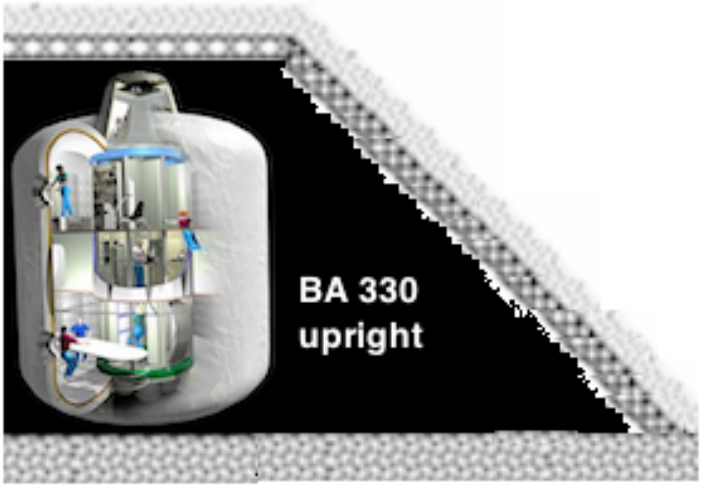


Illustration of the shielded ramada/hangar concept: Note that any type of shielded hanger could shelter upright BA 330 modules, difficult to shield otherwise. The vertical orientation offers maximum floor space.

ISRU (on location resource use) items that need research now:

- basalt-fiber technology is advancing quickly: can we make sand bags from such a material? What about sheeting strong enough to hold several feet (minimum 2 meters) of blown moondust?
- automated sandbag manufacturing
- automated production of sintered regolith lego blocks of standard size
- automated or teleoperated lego block wall stacking/construction
- compacting roller wheels (think steam roller size) shipped hollow, filled with compacted regolith

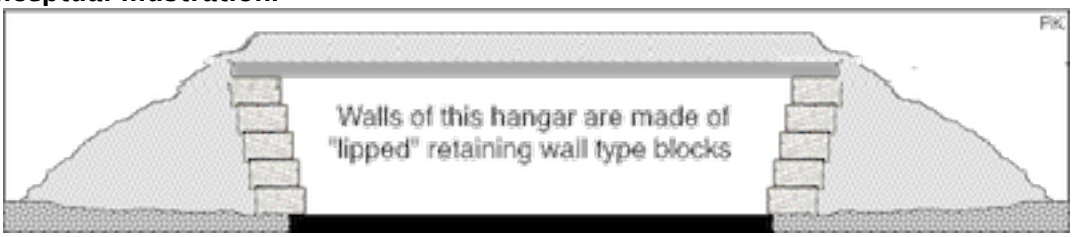
You can help!

Perhaps you can help fill in what we have missed or not thought of! Why not conduct local, regional, national, international engineering design contests to develop the ideas above.

The Good and the Bad of the above scenario for outpost establishment

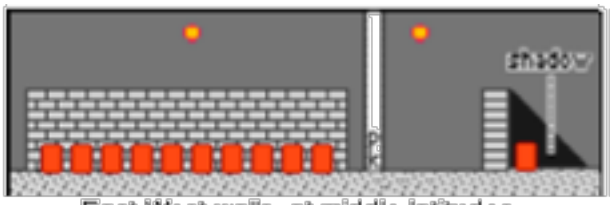
On the one hand, **very expensive on-location manpower** is reserved only for those things that cannot be done by teleoperated equipment or by telepresence-operated avatar robots. This also decreases the chances of serious injuries. Further, when the first crew arrives, and parks the modules they brought along or which have been pre-landed within the hangar/ramada structures, they will be ready to stay several lunar cycles, i.e. in ISS type length crew stints, for which 2 meters of pre-provided shielding will be ample.

Another conceptual illustration:

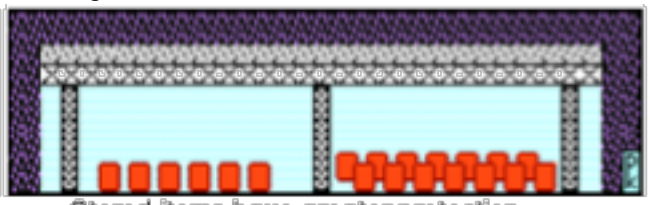


Beyond bricks: pavers and panels

Closely related to bricks are "pavers" which can be brick like in size and thickness up to much bigger slabs. These would have a use as well, for example serving as pavement for rocket landing/launch pads to cut down on the spray of sandblasting moondust driven by rocket exhaust. Such pads would be bermed as well to present a horizontal barrier; and these berms could well be confined between retaining walls.



East-West walls, at middle latitudes provide shade for stored drums etc.



Stored items have greater protection under a shielded ramada-hangar canopy

Panels, whether of concrete or made in the same moondust sintering fashion as bricks and blocks, could be held in place by Lego type blocks with forked ends. Panels, whether of concrete or made in the same moondust sintering fashion as bricks and blocks, could be held in place by Lego type blocks with forked ends.

The hangar interior can be **naturally lit**, during dayspan, by providing intermittent broken-path sun-wells or direct path "sundows" made of bundled optic fibers that double as shielding. Electric lighting for nightspan can be separately suspended from the ceiling or placed above the exterior surface, to use the in-place sun-well or sun-dow light delivery system. A light pipe network suspended from the ceiling could be fed by sulfur lamps.

Visual access can be accommodated by broken-path (radiation-proofed) mirrored shafts from the habitat modules underneath through the hangar roof. With proper planning, such ready-access observation ports can be provided ahead of time as the hangar is expanded section by section. Alternately, a pressurized vertical ladder-shaft can lead from habitat below to pressurized observation dome on the hangar roof.

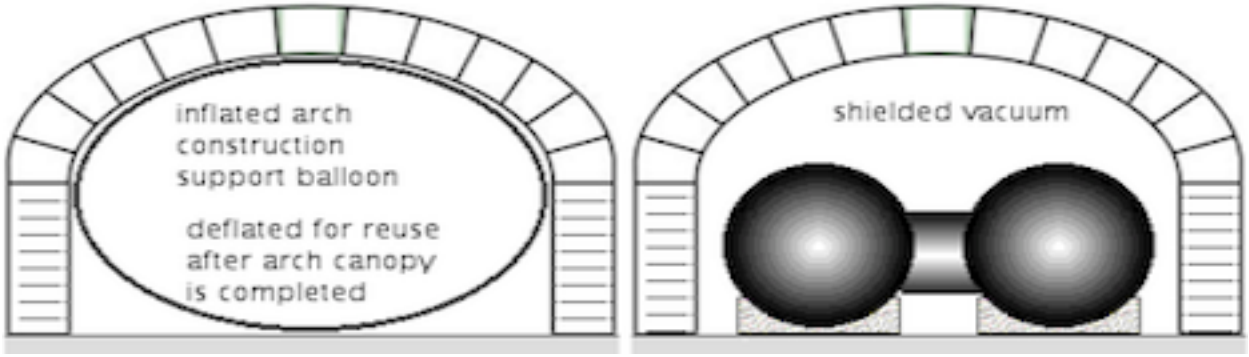
Who gets to teleoperate the brick making and deployment controls?

Such a project, coordinated with NASA or any other contracting tenant, would be an early indication that a base was about to become real. Indeed, we think that we can make this proposal even more interesting by expanding on the teleoperation angle. Finding ways to select individuals from the public at large by lottery of other means and give them a turn behind the brick/block manufacture and deployment teleoperation controls, would give this project significant public attention. The use of supervised students selected by lottery would be even better.

We'd have to train the lottery winners, and they would only get a chance to do actual work on the Moon remotely, if they demonstrated a required level of expertise. But to win and then be approved for this privilege and then actually get to do some of the work on the Moon would be a lifetime feat, something to tell the grandchildren.

Afterthoughts: Blocks designed for arches:

There is another way to create a brick/block shelter before any pressurized modules arrive from Earth. That would be to use blocks designed for arches. You could build interlocking rows of arches over a temporary supporting inflatable structure.



This slip-form sintered arch-block approach is well-developed in the paper "Lunar Base Design" by Peter Land of the Illinois Institute of Technology, pages 363-73, in "Lunar Bases and Space Activities of the 21st Century", Ed. W.W. Mendel, Lunar and Planetary Institute, Houston, 1984.

The '**ground**' under the arch (the floor of the hangar) can be graded smooth, compacted and sintered to provide a relatively dust-free apron for the sheltered outpost. As we will see in a later article, "site management", dust control, and good housekeeping habits must be in place from the gitgo if our attempt to establish an interface beachhead is not to fall flat on its face. (Inner and Outer "Yard" Managers or yardmasters will be critical job slots.) The hangar approach favors the early adoption and rigorous pursuit of good homesteading habits.

Conclusion: There would seem to be many options to providing ready to use shelter for the first crews before they arrive. We need to further brainstorm and pre-engineer each line to see which is the most problem free not only architecturally but with a view to teleoperated pre-construction, and to utility and versatility of use.

Which options could be further shielded to provide adequate protection for crews staying up to a year or more? If several sites are to be developed, and that is likely, then the most promising technologies should all be tested and tried, first on Earth if possible, then on the Moon. In time, a truly indigenous lunar-appropriate architecture will be developed and continue to be elaborated and refined.

The bottom line is the need to reserve expensively-supported crew hours on the Moon to those things that only crew on location can do. In time, the total pioneer population will grow more quickly, not less so, **because we have taken the time to do it right.**

We admit that the above ideas may not be appropriate for polar areas because basalt which we expect to play a crucial role in lunar industrialization is nowhere to be found. But it is time to get off "the Poles Only bandwagon." We do need polar ice for water and fuel. But one of the most fundamental enabling technologies, cast basalt and basalt-fiber products require mare or highland/mare coastal siting that provides access to both major suites of moondust materials. Those who are only interested in accessing the Moon for ice-derived fuels should keep developing their plans and scenarios. That said, the rest of us need to realize that water alone cannot help us transform the Moon into a new human pioneer world. The author's pick is a site on the "northern shore" of Mare Frigoris, the Sea of Cold. Why?

- **This places the outpost only about 200 mi (320 km) from the nearest ice-bearing craters to the North.** The pole itself is some 600 mi (960 km) north. The nearest "shore" to the south pole is double that distance.
- This site has **easy connections to the rest of the near side "mare-plex."**
- The Sinus Roris - Mare Frigoris plain stretches 150 degrees E-W. **A power grid with solar stations along the route, would provide power for some 83% of the local nightspan,** equalling the power coverage at the poles.
- **Thorium-rich (nuclear power) and KREEP-rich** (potassium, rare Earth elements, phosphorus) are to be found just to the South in Mare Imbrium.
- The Mare Frigoris area, at 60°+/- North, experiences **substantially moderated dayspan temperatures.**

Indirect Shielding Methods: Summing up

Building a dust-shielded "hangar" that provides large unstructured "lee vacuum" space in which pressurized modules can be "parked" in various forms of interconnection, offers a much faster, and easier way to set up an open-ended expanding modular outpost. There is no shielding to remove when adding additional modules, nor any directly applied shielding to interfere with servicing and repair of system components on modules a.

As a bonus, there is extra radiation-free, UV-free, micrometeorite-free, and flare-proof unpressurized "lee" service space for storing tankage and other routinely needed, frequently tended equipment that does not need to be exposed to the sky. This allows wearing light-weight pressure suits for some exterior housekeeping chores.

The hangar shed makes sense if there is firm, review-proof **commitment to phased expansion** of the base beyond the original bare minimum habitat structure. For while its construction adds an original base-deployment "delaying" mission or two, the time-saving and effort-saving dividends down the road are considerable. If our commitment is scaled back to putting a toe in the water, rather than to "getting thoroughly wet" with a wholesale plunge, then, of course, the hangar will be seen as unnecessary. But then we have an Apollo "Flags & Footprints" "Kilroy was here" repeat, and for what? Anything that is worth doing is worth doing well, and doing right, so that it becomes the foundation of something greater and not a just a stunt that leads nowhere.

Providing ready to use shelter will be even more essential for Mars explorers

Staying a year in orbit "within the van Allen Belts" is not the same risk-wise as staying a year on the Moon, where radiation shielding is strongly recommended. It will be even more so for Mars outposts which include travel time to and fro at risk. Crews arriving on Mars will already have been exposed to maximum acceptable limits of radiation. They need to have usable shelter immediately upon landing., not months later! This will minimize the chances of serious construction accidents in a place where getting to a hospital can be months, even years away.

Teleoperation and telepresence operation of equipment and robot avatars on distant Mars will be exceedingly tedious because of the 6-40 minute time delays strictly enforced by the speed of light. It would be helpful first to create shelter under the surface of Phobos or Deimos for teleoperators and telepresence operators who could then direct construction of surface shelters almost anywhere on Mars other than at the poles, in near real time. Those whose impatience demands that they bypass the "PhD" accelerator, will hopefully give way to those of us, who like the tortoise, realize that the fastest way in the end, is the most deliberate and carefully thought out, and patient way to do anything. **PK**

Lunar Supercomputer Complex: 21st Century DSN Evolution Prospects

(DSN: NASA's Deep Space Network) - AIAASpace2012_Chang_Thangavelu_paper.pdf

http://www.newscientist.com/blogs/onepercent/2012/09/**supercomputer-moon**.html
http://www.wired.com/wiredenterprise/2012/10/**supercomputer-moon**/

By Oiling Chang and Madhu Thangavelu

Ouliang Chang is a graduate student, Madhu Thangavelu is an adjunct professor,
both at Department of Astronautical Engineering, University of Southern California, Los Angeles, CA, USA

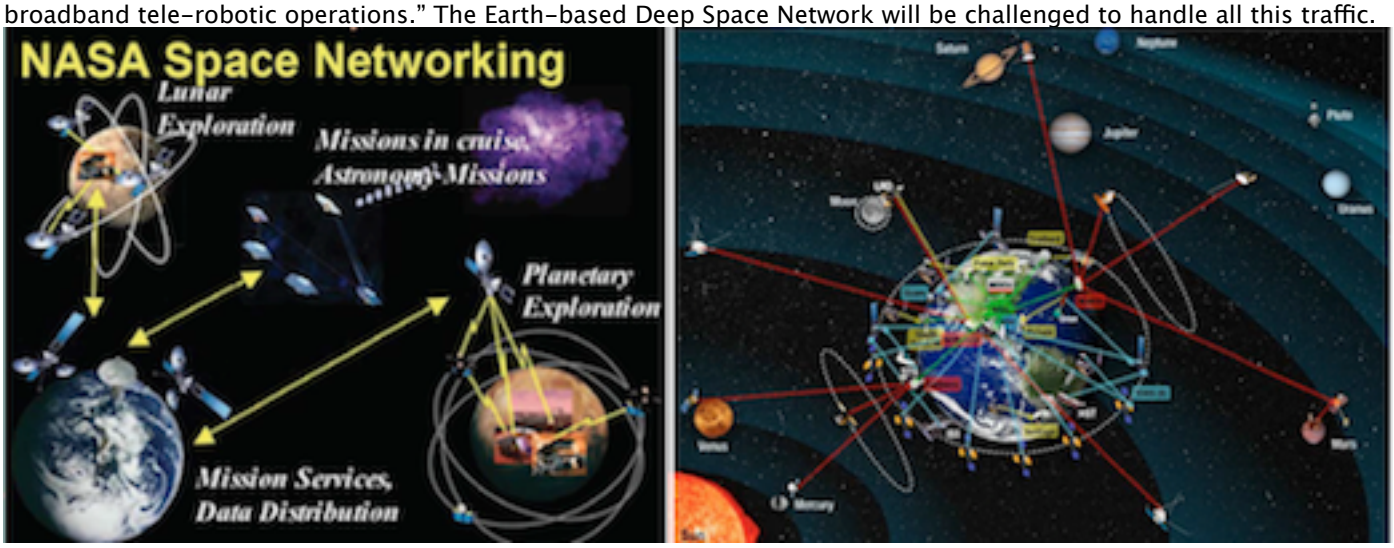
(Synopsis by Editor, based on their paper and online report about it, link above)

NASA currently controls its deep space missions through the Deep Space Network of huge satellite dishes in California, Spain and Australia. But with the increasing number of missions and data, the system could soon be overwhelmed. Australia is adding more dishes, but this can only serve as a temporary stopgap.

NASA is looking into building a laser-based system, as opposed to radio, capable of handling vastly more traffic - http://www.nasa.gov/centers/goddard/news/releases/2012/12-074.html

More continuous and extended missions and high-fidelity broadband telerobotic operations

But there may be another solution, say Ouliang Chann and Madhu Thangavelu, namely building a Super Computer Complex on the Moon itself as a new off-Earth Deep Space Network to handle "the more and more continuous missions and current duration-extended missions as well." "it is also expected that the first phase of lunar industrial and settlement development will commence, focusing on projects and missions employing **high-fidelity,** broadband tele-robotic operations." The Earth-based Deep Space Network will be challenged to handle all this traffic.



NASA's Earth-centric-processing space communications and processing space communications architecture

Conceptual graphic of the future lunar supercomputer complex as part of
an Earth-Moon Dual-Nexus 21st Century Deep Space Network

Earth-Moon Dual-Nexus Network Features and Benefits

- much needed system **redundancy**
- much faster signal processing employing **antennae placed on the lunar far-side**
- fast computing and **data processing ability for lunar developments and settlements**, such as imaging and **data transport for observatories**, real-time **teleoperations** and **complex guidance, navigation and control maneuvers for lunar service vehicles**.
- Lunar environment monitoring activities (**solar storm early warning** and l**unar surface charging forecasting**

Objectives of this Exercise

- Foster the creation of **innovative architecture concepts for future space exploration missions** using aerospace system engineering/architecting tools, evaluated by academic/industry experts at mid-term and final presentations.
- Creation of concepts to reinvigorate human space exploration following the retirement of the Space Shuttle

This concept was developed by Ouliang Chang under the supervision of M. Thangavelu during the Fall 2011 session of a graduate course offered by the Astronautical Engineering Department of the Viterbi School of **Engineering** at the University of Southern California. ASTE 527: Space Exploration Architectures Concepts Synthesis Studio. >>>

International Space Advocacy Organizations Encouraging Student Participation

National Space Society (US) – http://www.nss.org – **NSS**

NSS currently has chapters in Australia (3), Canada, Germany, France, Netherlands, Brazil, and India (3) – http://chapters.nss.org/a/lists/

NSS' International Space Development Conference – usually held the last weekend of the last Monday in May (Memorial Day weekend) in various locations, hosts students from around the world, many of them presenting their entries to NASA's annual Space Settlement Design Contest. Usually, The Moon Society and SEDS participate in this conference.

The Moon Society – http://www.moonsociety.org/chapters/ – **TMS**

The Moon Society has informal relationships with the Calgary Space Workers, Calgary, Alberta, Canada and with the Sociedad Espacial Mexicano, Mexico. The Society has individual members in many countries.

Students for the Exploration and Development of Space – SEDS

http://www.seds.org

SEDS has had greater success in setting up chapters around the World than any other Space organization.

How to Stars a SEDS Chapter – http://wiki.seds.org/index.php?title=Start_a_SEDS_Chapter

http://seds.org/chair/ChapterExpansionKit30.pdf

SEDS-Earth – http://earth.seds.org/index.php – This is the international chapter.

There are chapters of SEDS around the world: (USA), **India, Nigeria, UK, Philippines**, and more; SEDS-Earth is a central node for communication between these worldwide chapters.

SEE page 2-3 for a more complete list

NSS Space Settlement Design Team at ISDC 2012 Participants NSS Open forum and Plan to Form NSS Student International Chapters

By Dave Dunlop

At the International Space Development Conference held in Washington D.C. May 24-28, 2012 over 270 students came from 10 countries to participate in the Space Settlement Design Competition sponsored jointly by NASA, lead by Dr. Al Globus of NASA AMES, and Lynne Zielinski, NSS VP for Education. These teams met with a variety of National Space Society Board members and heard presentations on topics such as Space Solar Power Satellites, the problems of space debris, the need for more attention to the threat represented by Near Earth Asteroids, and the new opportunities for opening the frontier because of lower cost access to space. A dramatic opening of the ISDC Plenary Session was a speech by Dr. Charles Bolden, NASA Administrator who addressed the meeting even as the Space-X Dragon capsule was docking with the International Space Station, shown live on large TV screens behind him.

Students displayed their posters in an exhibit hall dominated their work which showed a great deal of imagination, background research, and skills in presentation. As Chair of the International Committee I also hosted a Student Open Forum, along with members of the NSS Board of Directors from the Membership, Web, Chapters, and Education Committees. Students were invited to address two question at the Open forum. First, what practical steps can you see in your on country in the application of space technologies to important national issues. Second, how can the NSS organization assist you in addressing these concerns as a space advocacy organization?

On Sunday morning over 150 students jammed into the conference room that was set aside with standing room only to with representatives from each team invited present their statements. NSS board were gratified to see this level of interest from both the student teams and their teachers and team mentors. I have appended a synopsis of these comments at the end of this article.

Students expressed excitement to be part of this diverse conference but also expressed in interest that NSS meeting such as the ISDC be held in other areas of the world. We encouraged students to participate in forming chapters in conjunction with their schools and many of the teachers at this forum who had participated at the ISDC Conference Competition also offered their assistance in this regard.

NSS also anticipates the development of some new unique components to its education program with opportunities to conduct experiments on the International Space Station and to win O-G flight opportunities.

As a result of this Open Forum the NSS has begun to streamline its process for enrolling new student members and the formation of student chapters at a sponsoring school. Some 10 to 12 groups expressed interest in forming new student chapters. Planning is already underway for the NSS Space Settlement Design Contest and Education Track at the 2013 Conference in San Diego and we look forward to expanded participation next year building on the success of the 2012 ISDC.

Student Open Forum Appendix

Present were some 50-100 students in teams from Bulgaria, India, Romania, Singapore, and the US:

Some of the ideas suggested included:

- NSS should hold more international meetings and expand our international partnerships!
- ISDCs are a good idea and we should have more of them across the world.
- Facebook is not enough and direct interpersonal contacts are important!
- We might find an affiliate organization in the Bulgarian Astronomical Society which engages people.

Suggested Google Floss.

- NSS should be much more global and should address issues that affect all humanity such as opening up the resources of space and asteroid mining.
- NSS might use the human and intellectual resources in Singapore, which might also be a good place for an international conference.
- We could do a better job of advertising and sharing information about the design contest..
- NSS should try to integrate its members into schools and conduct workshops, and have ambassadors.
- We should address issues such as Life Support systems and asteroids.
- A teacher in India who has attended ISDC with students in 2009, 2010, 2011, 2012 suggested that we provide a letter of recognition to Dr. Abdul Kalam.
- From a student who had attended Space Camp in Huntsville: NSS should develop a Space Camp in India (Ronnie Lajoie indicated he would pursue this with Space Camp personnel in Huntsville)
- NSS is not reaching teachers and guidance counselors.
- Not enough outreach.
- More NSS Ambassadors.
- I learned more in three days working on the Space Settlement Design Contest than in a month in school
- NSS might have some practical workshops.
- Paul Werbos spoke about the Research Experience for Teachers program of National Science Foundation.
- Do something to promote protection of the Earth! Why not a design contest do to this.
  (NSS Vice-President for Education Lynne Zielinski challenged this student to work with her toward this end)
- NSS could have student debates on Space Issues
- NSS could publish a magazine on space settlement design.
- We had an offer to assist NSS in its web committee from Paul Sudahkar.

NSS Recognizes Student Space Settlement Design Winners From Around the World

By Lynne Zielinski

Beginning in 2006, the NASA Ames Research Center and National Space Society have jointly sponsored a Space Settlement Design Contest. Each year, the students amaze everyone with their imagination, innovation, and determination, and this year was no different. This year's International Space Development Conference boasted a record number of energetic students from around the world. More than 280 students from 10 countries, along with their teachers, parents, and administrators gathered together to share their award-winning space settlement designs.

Sixty-six teams were recognized and presented their spectacular space settlement designs in a poster session at ISDC, while 25 teams gave 10-minute oral presentations of their space settlement designs sprinkled throughout the four-day conference.

The excitement for the students began on Thursday evening when they met for an orientation and welcome by NSS Board Chairman Kirby Ikin, NSS Chair of Education and Outreach Lynne Zielinski, NSS Director and founder of the NSS/NASA Ames Space Settlement Design Competition Al Globus, and other NSS board members and committee chairs.

At the Saturday morning student awards event, commercial space advisor and chief propulsion engineer Tim Pickens inspired students with his out-of-the-box presentation of how the model rocketry hobby of his youth led him to become a leading rocket engine designer and entrepreneur today. Afterward, Zielinski presented certificates and recognized the students' achievements by announcing the winners from each grade level and award category. Globus and Pickens took team pictures. The Romanian students were graced with a visit by Ovidu-Adrian Tudorache, Second Secretary of the Political Section of the Embassy of Romania.

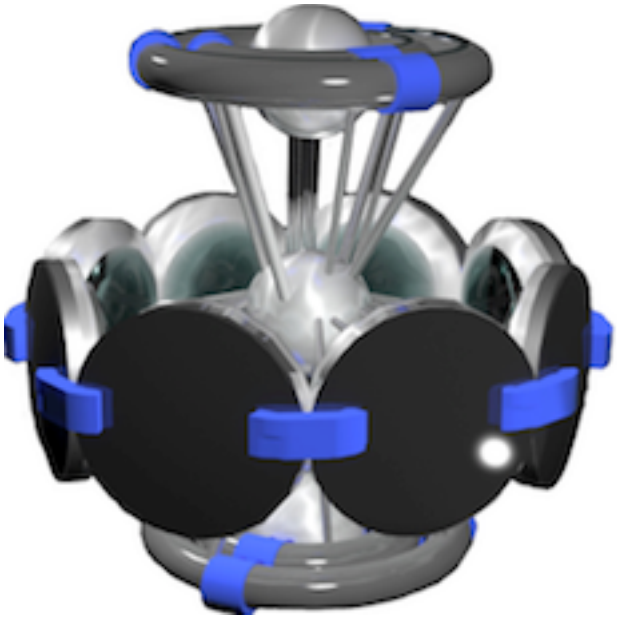
Members of the **Aurora Earth Orbiting Station** accept the top prize in the NASA Space Settlement Design competition at ISDC 2012

http://settlement.arc.nasa.gov/Contest/Results/2012/**aurora__cnitv**.pdf

On Saturday afternoon, the students offered brochures, flyers, and computer simulations to conference attendees during the two-hour space settlement poster session. At the Saturday evening dinner, Zielinski and Globus presented each of the two tied Grand Prize winning teams—one from the United States and the other from Romania—with a Bathsheba Grossman cubical crystal sculpture. The sculpture accurately depicts the stars in the nearest 5 parsecs of space surrounding our star Sol. The sculpture reflects the National Space Society's long-term goal – the human settlement of space, not just on Mars or the Moon, but around the planets of other stars — thus ensuring the longevity of the human race.

The Tudor Vianu National High School of Romania team presented their space settlement vision first, with "Aurora: Earth Orbiting Settlement" by members Bogdan Alexandru Cionca, Anca Elena Gheorghe, Raluca Turcu, Maria Silvia Uzum, Alexandru Cristian Dragomir, and teacher Ioana Stocia. They were followed by the Cypress Bay High School of Weston, Florida, with "The Kon Tiki" project, presented by members Robert Gitten, Zared JM Schwartz, Eric De La Espriella, Samuel Tagger, Jacquelyn Shira Linevsky, Siobhan Buckley, and teachers Jeffrey Rose and Angela Ashley.

The two teams split the $5,000 Bruce M. Clark, Jr. Memorial Scholarship presented by Bruce M. Clark, Sr. in memory of his son, who was an avid science fiction book collector and supporter of space settlement. Mr. Clark stated that "…had this competition been around when he was in high school, Bruce would certainly have entered it." Clark also announced that some of his son's ashes flew into space aboard the Falcon 9 spacecraft that was successfully launched in an historic rendezvous mission with the International Space Station Friday morning, highlighted by NASA Administrator Charles Bolden during the ISDC's opening session.



Aurora Earth Orbiting Station

Students and teachers from the "**Kon tiki**" team in the NASA Space Settlement Design Contest, pose with Howard Chipman and Veronique Balsa-Koken of Aurora Aerospace, (center) who donated a zero-g flight to each winning team at ISDC 2012.

http://settlement.arc.nasa.gov/Contest/Results/2012/**KonTiki.**pdf

On Sunday morning, students gathered together for the first International Student Open Forum, where they shared their ideas with a discussion on how they see space shaping the future of their country and how the National Space Society can help them achieve these goals. Student enthusiasm was high and one felt that the stage is set for a new generation to take the lead. NSS Director David Dunlop, who led the forum discussion, commented that the overwhelming mantra received from the students was that there ought to be similar events like the ISDC in their countries.

As a whole, the student teams impressed the 2012 ISDC attendees with their passion, depth of knowledge, and innovation. NSS would like to thank all the students, teachers, parents, and mentors for their enthusiasm and dedication that will help to make human settlement of space a reality. Next year, we hope to embrace the youth and innovation of a whole new group at ISDC 2013 in San Diego, California, USA, May 23-27. More information about these and other NSS supported student competitions can be found at http://www.nss.org/contests/ .

Finally, the biggest surprise of the evening was the announcement president of Public Affairs, chair of the Education and Outreach that Dr. Howard Chipman and Veronique Balsa-Koken from Aurora Aerospace would provide each team with a free zero-gravity flight aboard a Rockwell aircraft. >>>

Lynne Zielinski is a member of the NSS Board of Directors, vice president of Public Affairs, chair of the Education and Outreach Committee, and retired physics teacher living in Long Grove, Illinois.

[The articles that follow are reprinted from recent issues of **Moon Miners' Manifesto India Quarterly** as they may be of some help to those trying to start local space-interested organizations or chapters for people of all ages. - Editor]

The Loss of the Night Sky affects People and Nature Alike
Young People can lead the Campaign to "Take back the Night"

By Peter Kokh

The World at Night: Bright city lights in growing urban areas are becoming more and more of a problem.

Yes, they look pretty from space, but who is in space to see them other than astronauts at the International Space Station? More to the point, how can young people in urban areas become interested in space if they can't look up at night and see the stars because of all the light pollution?

In any campaign to change this situation, it will be best to point out that all light reflected upwards at the sky, is wasted energy. Organizing to address this problem, is a good way to find others who might be interested in space and in humanity's future as a space-faring species.

A campaign to Take Back the Night, whether it be undertaken in a large urban area or in small towns and villages, has the capacity to bring together people from many walks of life and with many professions and affiliations. Teachers, Boy scout and girl scout leaders, artists, photographers, nature-lovers might be eager to participate - not just astronomers and space enthusiasts. And whether the effort has some measure of success, succeeds wildly, or even, we hope not, fails to change the situation, one result will be a broadly based team that has learned to work together to get things done. Not all of this varied gathering of leaders will be interested in space exploration and human achievements in space. But some might, and together, using techniques and methods with which they have had some encouraging results, you will not only have earned community good will, but you will have built a core around which to build a local space interest organization.

It is best to keep the focus broad: all things space, pushing all destinations, all projects, even if the group chooses to focus on one limited narrowly-defined goal at a time. And if all such groups born of an effort tot take back the night form some sort of national alliance, well then this broad-based organization will speak with a voice that commands respect and has influence.

You will need people who enjoy working with politicians (many do not), researchers in various laboratories, professors with various specialties, teachers, writers, artists, agricultural specialists, materials scientists: the list goes on and on as almost everything has some mutual relevance. And many projects require a strategic mix of talents that complement each other one way or another.

The country in which you live may not have a tradition of "grass roots politics." The point of this essay is that it may be hard to put together a local, regional, or national organization of people interested in promoting your country's future in space. But here is a cause that many people from a great variety of backgrounds and with a great variety of talents and with varying levels of expertise can come together and rally around: "**Taking Back the Night**!"

The spread of excess urban lighting has been going on for some time, all around the globe. Yet many people everywhere of various ages must still remember the awesome beauty of the night skies. Perhaps many of those who grew up in already brightly lit cities, may have traveled in rural areas on cloudless nights. They will remember the awe they felt, and come to regret that this experience has been taken away from them as city dwellers.

This is a cause that can unite generations, young and old, city dwellers and country folk, the educated and less-educated. This is a movement that can start small, fail here and there, but if it succeeds somewhere, anywhere, that will embolden everyone else. people of all nations, should ask: Is it our national priority to be extra prominent from space on cloudless nights? Or is it our priority to have our people grounded in the splendor of the heavens, their feet on the ground, but their vision and dreams knowing no bounds.

Most cities around the world have growing air-pollution problems. Light pollution should not be overlooked even if its causes are different. City dwellers have as much right as anyone to see the stars, and to reach for them! In some remote areas of many countries, one can still enjoy the stupendous sight of thousands of stars above in the night sky. But in many metropolitan areas, one is lucky to see a hundred of the brightest ones. Meanwhile, any nighttime clouds have their undersides lit up in pinkish tones, making one who remembers when it was not so, wonder if they had been transplanted to some exotic alien planet. It might be pretty, but the effect is to cheat us of something that has been ours since the dawn of time: the view of the awesome star-studded heavens at night. Some city dwellers who born in these present conditions, and have never seen how different the heavens look far outside the cities, must wonder if those who talk of exploring the heavens: the Moon, the planets, and someday the stars, are not insane!

This phenomenon is a "problem to be solved" and not something we have to take as "the new reality." Many cities in the US have bowed to pressure from organized groups of students, teachers, and amateur astronomers, and successfully argued for different types of lighting systems that did not waste light and electricity illuminating the undersides of clouds, but yet did a better job of illuminating roads and streets - all for less energy expenditure. By showing how the city could save money by making the switch, they overcame opposition. That young people would be able once again, as had innumerable generations before them, enjoy and wonder and speculate at the awesome sight of countless stars, may have energized these "activists" but they won their case on other grounds: showing that the cities could save considerable sums of money.

An article in Space Review written two years ago that addressed this question came to our attention. It was a review of an 84 minute film entitled "The City Dark" - http://www.thespacereview.com/article/2017/1 - The story describes two opposite experiences, the first of a young city-dweller when he first got to see the skies on a moonless night far from a city; the second of a lad who grew up enjoying star-studded skies in the country side and then moved to the big city where all this was lost. We thought that some of our readers in urban India and elsewhere might appreciate reading this review.

It is not too late to recover the heavens that have inspired our ancestors for thousands of years. That sight should be our privilege. We cannot understand Earth apart from the Solar System, much less apart from the universe at large. And if we want to re-acquaint our young people with Earth's greater context, we owe it to them, and ourselves, to agitate successfully for sky-respecting urban lighting systems. It will also benefit urban and suburban wildlife and vegetation which had evolved in the natural darkness of the night. The clinching argument is that it will save money, and taxes.

Most of us know one or more amateur astronomer friends, who are oddly aloof to the cause of the space frontier, if not openly hostile. For those of us who come to the space movement out of a prior interest in astronomy, myself included, this seems puzzling indeed. **To us, studying the stars and wanting to go out there are one and the same.** But there are reasons for the uneasiness some of these fellow spirits show around us, and with a little self-examination, they are not hard to find. **If we love the stars, we should spare no effort to preserve our ancestral right to see them.**

Which bring us to a point well taken by Diane Fearne-Desrossiers of Lansing L5, Michigan: "how can we expect city dwellers to be interested in space, when we can no longer see the stars from within the city? We ought to join ranks with those in the astronomical community fighting sky pollution from unnecessary use of unshielded and high-pressure sodium vapor city lighting." If those in San Diego and Tucson who have fought the good fight and won would be so kind as to give the rest of us a primer (background knowledge so that we will know what we are talking about, plus campaign methods) we'd be on our way to restoring dark skies and the lure of the stars to all our land.

Let's Take Back the Night! **PK**

Relevant Light Pollution links:

http://en.wikipedia.org/wiki/Light_pollution

International Dark Sky Association - http://www.darksky.org/

The Night Sky in the World - http://www.lightpollution.it/dmsp/

Eastern USA, Central Europe, Japan are by far the worst! http://www.lightpollution.it/worldatlas/pages/fig1.htm

http://www.starrynightlights.com/lpIndex.html

For relevant Videos enter "**light pollution of night skies videos**" in Google Search

Needless Light Pollution - http://www.need-less.org.uk/

Light pollution dulls the night sky for stargazers - and drains city funds

http://news.medill.northwestern.edu/chicago/news.aspx?id=165102

Leveraging the Sky

By Peter Kokh

It's a fact: in any country, there will be far more local astronomy clubs than space-interest chapters. While astronomy buffs and space enthusiasts may have differing goals and interests, there is clearly some overlap, and it makes sense to leverage that. Doing so makes sense even for established chapters in large urban areas. But it could be especially helpful for those with small chapters, and especially so for lone individuals who would like to start a local Space enthusiast chapter, but who are still at the "Outpost stage" (one or more persons looking for others to start a full chapter, and now serving as local contact.)

The splendors of the nighttime sky include Mercury, Venus, Mars, Jupiter, and Saturn, not to forget the brightest asteroid Vesta and an occasional comet - **but above all, the Moon!** And for the Moon, a pair of binoculars will be enough to provide stunning views. While many amateur astronomers are focused on stars, double stars, variable stars, star clusters and nebulae, and faint galaxies, most also are interested in the planets when they are in good observing position.

What can one Moon/space-enthusiast do, starting in a local astronomy club?

1 **Give talks and presentations** about the Moon, and its resources that could change our future; focus on areas of special interest such as sinuous rilles and the lava tube networks they imply. Divide your topic into a series of such talks for monthly meetings.

2 **At observing nights** open to the public, volunteer to be the one to show the planets that happen to be up, and the Moon, while other club members focus on showing visitors the stellar sights. Prepare to answer questions and to talk about past & future probes and what we have learned and hope to learn from each.

3. **Download pamphlets** and flyers about the Moon Society, its vision, mission, and goals, and how to join with a pitch about your chapter or outpost.
http://www.moonsociety.org/downloads/

4. **Be knowledgeable about ISRO projects and programs** and have brochures and other printed matter to hand out.

In time you may find others who would like to join you in starting a Moon/Space club or chapter. To do this you need others, and a local astronomy club is a good place to start. Have a notebook to take down names, addresses, email addresses, phone numbers and information about each person's interests and "buttons" (topics or issues of special interest to that person.) Also try to find out each person's special talents and expertise. This information will help you follow through when you meet people who share your enthusiasm, at least in part. Have a simple business card so that others can find you and share information with you and work with you.

5. **Keep informed about upcoming rocket launches**, whether they are of satellites or Moon orbiters and probes. Anniversaries of important space events like the first man in Space – Yuri's Night, or the first Moon landing, or the first ISRO rocket launch. You may be able to host a party for others interested in watching and following or commemorating the event as the case may be.

6. **Try to find projects that suit the special interests and talents of those you find** who want to help start a Moon/Space club. That way you will have better results.

7. **Build a group library of books owned individually but which can be shared.** Give reports or reviews on books you find informative and/or helpful.

8. **Keep in contact with other local Moon/space groups** that you learn about. You can learn from each other, even do joint projects or events with them, building a mutually supportive network.

9. **Start a group Facebook Page** on which you can share information and reports and projects.

10. **Collect email addresses** and send them to mmm-india@moonsociety.org so that we can send these persons notices when the next issue of MMM-India Quarterly is ready to download!

11. **If at first you get no positive reaction, keep trying,** and that by itself will get attention. Remember, "it isn't easy, but it is worth it!" PK

Community – Growing a Local Chapter by Collaboration

By Peter Kokh

Foreword – While there might not be a local space chapter in your community, do not hesitate to read what follows as you may get ideas that will help you to find one or more kindred souls and to organize one successfully.

Potential Collaborating Organizations

● **Local astronomy clubs** – In issue #12, we talked about "Leveraging the Sky" to focus interest on space. But there may be other "special interest" groups or clubs in your area with whom it may also be fruitful to collaborate.
http://www.astronomyclubs.com/country/India

● **Local science fiction societies** – Some larger urban areas may have organized clubs whose special interest is science fiction. –

● **Local geological societies** might be interested in presentations about the very different geology of the Moon, Mars, the asteroids, and "moondust." You just might attract one or more "rockhounds" to join the chapter. – http://www.geosocindia.org/

● **Mensa chapters** – these are organizations of intellectually gifted persons with an A-Z spread of interests. They may be fascinated by your presentations may even join, bringing useful talents and connections http://www.mensa.org/country/india

● **Other local space chapters** – No matter how cozy or strained relations between your National organization and other national space-interest organizations may be, you will find that individual members are largely disinterested in such non-productive politics. You can trade presentations with other local space groups, put on joint exhibits and events, and share talents. Send out invitations to attend any of your meetings when you have a special speaker or presentation, whether it is about space in general, ISRO plans, India's astronauts, International Space Station, Moon, Mars, Asteroids, or any other space destination or topic. Most of us are interested in all things space.
http://chapters.nss.org/a/lists/International/ChapList_IN.shtml● **Local Libraries** – The central library in your community may have a **list of local organizations** of various types. (And if your startup group is not listed, have them add it to the list so others can find you!) If so, go through the list and brainstorm possible common points of interest.

For example an auto club may be interested in a talk or presentation on the Apollo moon rovers, and ideas for pressurized lunar coaches. A fashion club may be interested in a talk about what lunar pioneers might wear. A sports club may be interested in a speculative talk about what shape sport might take on the Moon in 1/6th gravity or on Mars with 3/8ths gravity. A law or legal club may be interested in legal issues that will come up on the space frontier. No matter what groups you find in your community, if they are looking for speakers, there is probably z space frontier topic that will be of interest to them.

If you can't think of a topic, or need a list of god talking points, email me at kokhmmm@aol.com and I will make suggestions and provide background material or existing presentations. "Nothing to lose and much to gain!" Making a presentation will improve your speaking skills. Don't be nervous. You will know more about your topic than your audience!

Making the first move

If you learn about a group of whatever focus that is looking for speakers – every group is! – **pick a topic or list of topics that has aspects that might appeal to them**, You may have to learn about them first to find that common ground. Then write, email, or call and offer to be a featured speaker. If your talk is favorably received, and they invite you back, do accept that invitation, and invite their members to attend one of your events.

Get acquainted with their movers and shakers and with the talents they have. This could lead to your chapter cosponsoring one of their events, and with their group returning the favor, and perhaps offering you a speaker in turn.

Keep a detailed contact directory/address book of each group's leaders, specifying role, and useful talents. Offer to exchange courtesy newsletters and publications. Put them on your mailing list for your chapter's events and efforts. Undoubtedly, you will find some groups to have less collaboration potential than others. But becoming known to any group can turn out to be an asset someday, when they realize that you have something of value for them.

Study each group's successful ventures for clues about how to improve your chapter's efforts. In other words, become acquainted with your community's amateur talent pool and their activities.

Before you take it upon yourself alone, see first what connections to other groups other chapter leaders and members maintain, and ask them give a preliminary report. That can lead to group brainstorming of how to establish working connections with this group. The more brains exploring the options, the more likely you will come up with a promising "first contact".

As your chapter is undoubtedly looking for meeting speakers as well, invite speakers of other clubs to tell your members all about their activities. Follow yup with an open floor discussion that identifies areas of common interest to pursue together. Collaboration is a two-way street.

The **"Undiscovered Country"** – to borrow the title of a Star Trek film – is waiting for you to explore it!

PK

An Easy Exhibit to interest others in observing the Moon

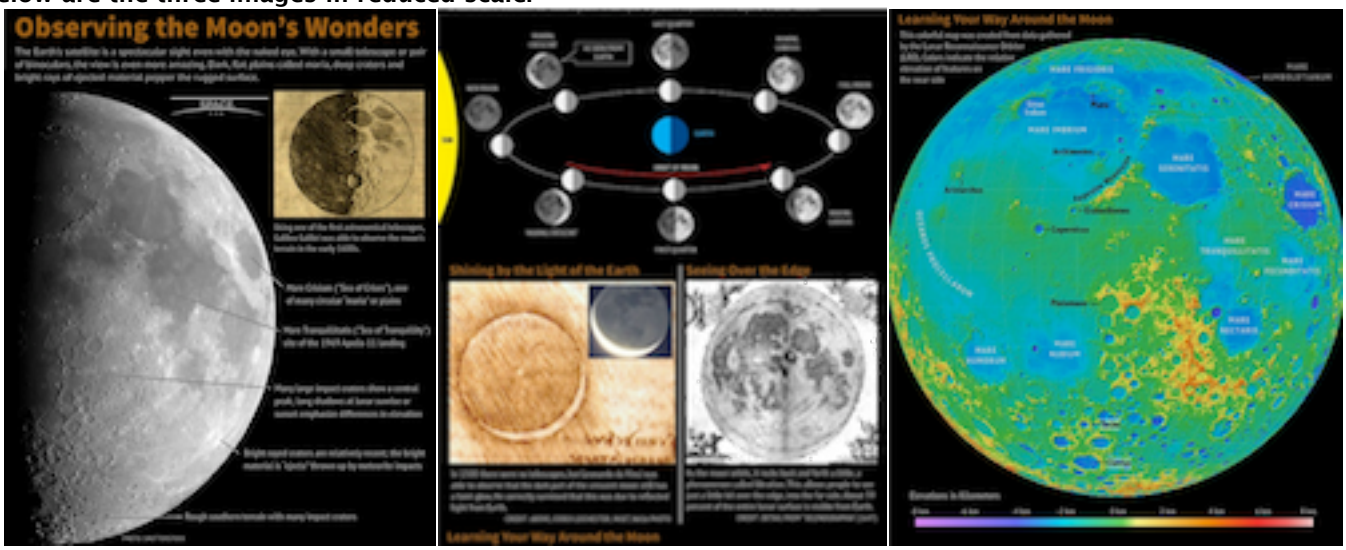
By Peter Kokh

Recently, Space.com published a great addition to their library of "Infographics," about Observing the Moon.

http://www.space.com/17702-**how-observe-moon-skywatching-infographic**.html

The image of the infographic is 575 pixels wide by 2797 high, a daunting thing to reproduce as an exhibit. I have divided this image into three sections, each of which can be printed on regular 8,5"x11" card stock and placed either in a column or in a row. A 4th page contains the explanatory text in the site above announcing the publication of the infographic. Together, these 4 printouts will make a nice addition to any chapter exhibit.

Below are the three images in reduced scale:



Just mount on a display board and you have a nice addition to your chapter exhibit collection. This would be especially helpful if your chapter wants to try "Sidewalk Astronomy" as an opportunity to stage outreach events without piggybacking on anything other than the Moon's appearance in a clear evening sky. For information, see last month's issue, MMM #258, page 10, under the heading "International Observe the Moon Night."

Check out many more potentially useful Infographics: http://www.space.com/**infographics**/

You can make a set of Earth-Moon-Mars "Gravity Jugs" – Easy and inexpensive. They will light up the eyes of people of all ages as they "get it!"

By Peter Kokh
http://nsschapters.org/hub/gravityjugs.htm

Three of the same size jugs – we used bleach jugs – filled with different amounts of water

Lift any two JUGS at a time to transport people to the Moon or Mars for a brief brain-expanding instant!

You will need:

- **(3) Jugs with handles:** I bought (3) 48 oz. jugs of Bleach (cheaper and more durable than half-gallon jugs of milk or jugs of liquid detergent and you can always use the bleach). Any brand will do. Where you live, the jugs will likely be sized in "liters." The jugs I bought were white and had labels that were easy to remove.
- **Some Styrofoam Peanuts:** if you haven't saved any from packages you have received, perhaps someone you know has a supply. As a last resort, you can buy them from package mailing stores such as Mail Boxes, Etc. of from Packaging Materials suppliers. A cubic foot, more than you will need, should not cost much. I just happened to have a supply (I save things I might someday find a use for – it's a habit.
- **Water**

Simple Instructions:

- **Earth Jug:**
  - Empty contents into spare container and rinse
  - Fill the empty jug with water
- **Moon Jug:**
  - Empty contents into spare container and rinse
  - fill with styrofoam peanuts or cut up cubes of Styrofoam small enough to fit through the opening
  - then add only 1/6th the amount of water that it originally had of bleach
- **Mars Jug:**
  - Empty contents into spare container and rinse
  - fill with styrofoam peanuts or cut up cubes of styrofoam small enough to fit through the opening
  - then add only 3/8ths the amount of water that it originally had of bleach

NOTE: The styrofoam peanuts help distribute the water evenly and prevent telltale "sloshing" – I had thought of adding Knox unflavored gelatin to gel the water / styrofoam peanuts mixture, but this proves to be unnecessary.
NOTE: Neither the weight of the plastic jug, nor of the styrofoam peanuts are factored in, being negligible for demonstration purposes.. Making the exact adjustment would not materially affect the sensing of different gravities.

Some Alternatives:

- **Jugs:**
  - Option: milk and cooking oil containers that also have handles, but may be less sturdy
  - Option: easy grip neck milk or oil bottles
  - Option: clear bottles or jugs give the opportunity to color code the fill material to the extent practical but would distract attention from the only impression you want to make - the different "heaviness" of the three jugs that show the difference in gravity on Earth, The Moon, and Mars.
  - Option: 3 of any other kind of container that is securely closable and easy to grip and lift. For example, at some hardware stores, you can purchase never-used empty gallon paint cans with handles.
  - Choose the cheapest option if you have to, otherwise allow yourself to do some imagineering! Durability through constant handling and ease of lifting are the primary qualities needed.
- **Water:**
  - Option: dry sand (higher density gives all three jugs more weight), or some other type of non-liquid pourable fill
  - Option: small size aquarium gravel, which comes in colors if you are using clear containers (blue for Earth, rust for Mars, gray for the Moon)
  - Rule: just use the same fill for all three jugs, in proportions specified.
- **Instructions:**
  - If using fine dry sand or other non-liquid pourable fill, still fill the Moon and Mars jugs with styrofoam peanuts first. If the sand is dry, you should be able to sift it in the interstices. Again the purpose is to distribute the mass evenly.
  - If you are using aquarium gravel, it may take some shaking to get the required amount of fill in between the interstices of the styrofoam peanuts, in order to distribute the weight. Some trial and error experimentation may be necessary.
- **labels:**
  - At the address given above () you will find labels that you can print out either on paper with an adhesive backing or on regular paper and affix them to the jugs with adhesive or tape. As an option, you can simply paint the jug caps in the appropriate colors: Earth blue, Mars rust, Moon gray.

Now you are ready to see the eyes light up, of people of all ages, as they suddenly understand (having felt it for themselves, the difference in gravity between Earth (100%) and The Moon (1/6th) and Mars (3/8ths) ###

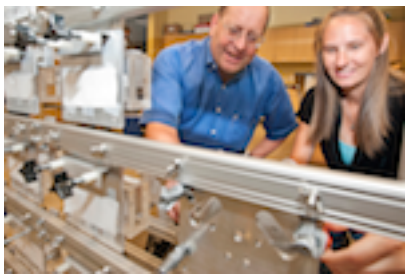
SpaceX Dragon Carries 23 Student Experiments to Space Station

http://www.nasa.gov/home/hqnews/2012/oct/HQ_12-347_SSEP_SpaceX.html

In the United States, regardless who wins the Presidential Election in November, both candidates, President Barach Obama or Governor Mitt Romney, the International Space Station will continue to receive cargo and crew shipments by Commercial space companies such as Space-X and Sierra Nevada and others, at significantly less cost than the service provided by the now retired Space Shuttle fleet. Both candidates have made clear their strong support for this switchover.

Space-X Dragon capsule made its first cargo delivery in May. Its second flight is scheduled to arrive at ISS on October 8th. The Commercial vehicles are fully reusable. In contrast, Europe?ESA's Automated Transfer Vehicles are not, and burn up upon reentry into the atmosphere. Redesigning them to return to Earth intact may actually cost less in the long run than having to build new ones for each mission. The same goes for Japan/JAXA's HTV.

The Dragon capsule scheduled to arrive at the International Space Station, will deliver, among other things, some 23 student experiments. NASA wishes to continue to encourage student involvement and participation in space. Student participants of the Student Spaceflight Experiment Program (SSEP) have put together 23 "Micro-gravity" experiments. "Twelve of the SSEP experiments are getting a second flight opportunity. They were delivered to the space station on a SpaceX demonstration mission in May, but were not completed. The other 11 experiments are new. Each experiment will study the effects of microgravity on physical, chemical and biological systems. " >>>

To The Stars International Quarterly Editors – initial team



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TTSIQ is looking for additional **co-Editors, Contributors, and Reporters**
from various nations and student groups, covering various topics.
Whether you can conribute regularly or just once in a while,
Your help will be appreciated.
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GREAT BROWSING LINKS

SPACE STATIONS + COMMERCIAL SPACE

http://www.space.com/16507-**private-spacesuits-final-frontier-design-photos**.html
http://www.space.com/16512-**fly-dna-moon**.html
http://www.space.com/16631-**private-liberty-rocket-space-capsule-milestone**.html
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http://www.space.com/16906-**private-space-taxis-nasa-spaceflight-reaction**.html
http://www.space.com/17720-**private-spaceflight-liability-california-law**.html
http://www.space.com/17599-**nasa-private-space-taxi-certification**.html
http://www.space.com/17654-**spacex-dragon-space-capsule-station-cargo**.html
http://www.telegraph.co.uk/news/worldnews/asia/southkorea/9428047/**South-Korean-artist-set-to-launch-homemade-satellite.html**

Troubles with Russia's Space Program – http://www.jamesoberg.com/oberg_aerospace_america_2012.pdf
36 photos of Baikonur Spaceport in Kazakhstan – http://www.yuga.ru/photo/polosa/1503-96568.html**oo**
Photo of the never used Soviet Shuttle "Buran" – http://www.yuga.ru/media/baikonur_b(25).jpg
Space Olympics Proposal to ISU – http://space.alglobus.net/papers/**ISU/SpaceOlympics**.pdf

ASTRONAUTS + SPACE TECHNOLOGY

http://cosmiclog.nbcnews.com/_news/2012/09/06/13707947-**neil-armstrong-to-be-buried-at-sea?lite**
http://www.space.com/17537-**antimatter-fusion-engines-future-spaceships**.html
http://www.space.com/17577-**nasa-spacecraft-3d-printing**.html
http://www.space.com/17634-**nasa-thors-hammer-satellites**.html
http://www.space.com/17601-**nasa-human-robotic-space-exploration**.html

EARTH

2012 Supernova unlikely to harm life on Earth – http://in.news.yahoo.com/**supernova**

MOON

http://www.panoramas.dk/moon/apollo-11-the-first-man-on-moon.html
http://www.panoramas.dk/moon/apollo-12.html
http://www.panoramas.dk/moon/apollo-14.html
http://www.panoramas.dk/moon/apollo-15.html
http://www.panoramas.dk/moon/apollo-16.html
http://www.panoramas.dk/moon/apollo-17.html

MARS

Making Mars a Better Place – http://www.thespacereview.com/article/2152/1
Mars Magma Study Questions Red Planet's Watery Past, Habitability
http://www.huffingtonpost.com/2012/09/10/-**magma-water**_n_1870939.html?
http://www.space.com/topics/**nasa-curiosity-rover-mars-mission-news/**
http://www.space.com/17306-**mars-rover-curiosity-red-planet-life-search**.html
http://www.space.com/17321-**mars-rover-curiosity-human-voice-photos**.html
http://www.space.com/16385-**curiosity-rover-mars-science-laboratory**.html
http://www.**panoramas**.dk/**mars/greeley-haven**.html
http://www.space.com/17620-**mars-rover-strange-photo-martian-rocks**.html
http://www.space.com/17656-**mars-rover-curiosity-mckay-qanda**.html
http://www.huffingtonpost.com/2012/09/27/**mars-stream-photos-images**_n_1920770.html
http://www.space.com/17805-**mars-water-streambed-curiosity-rover-infographic**.html

ASTEROIDS

Dawn leaves Vesta, on it way to Ceres – http://www.jpl.nasa.gov/news/news.cfm?release=2012-277
http://www.space.com/17497-**nasa-asteroid-naming-contest**-1999-rq36.html

OTHER PLANETS + MOONS

http://phys.org/news/2011-12-**nasa-europa**.html
http://www.space.com/17543-**jupiter-impact-explosion-pictures-amateur-astronomers**.html
http://www.space.com/17727-**mercury-surface-rare-meteorites**.html
http://www.space.com/17741-**europa-ocean-jupiter-moon-water**.html

ASTRONOMY + ASTROBIOLOGY

http://www.space.com/17392-**seti-alien-search-uwingu-funding**.html
http://www.space.com/17530-**universe-dark-energy-supercomputer-simulation**
http://www.space.com/17549-**dark-energy-real-universe-expansion.html**
http://www.space.com/17609-**alien-planets-sun-like-stars-cluster**.html (the well known "Beehive")
http://www.space.com/17657-**alien-planets-methane-meteorites-atmosphere**.html

GREAT SPACE VIDEOS

http://www.space.com/17797-**water-rushed-on-mars-curiosity-finds-video**.html
http://www.space.com/17586-**curiosity-s-hand-camera-images-penny-on-mars-video**.html
http://www.space.com/17540-**how-did-mars-lose-its-atmosphere-maven-aims-to-find-out-video**.html
http://www.space.com/17584-**pongsat-ping-pong-ball-satellite-mission-to-edge-of-space-video**.html
http://www.space.com/17608-**was-ancient-mars-a-wetter-place-curiosity-will-look-for-the-evidence-video**.html
http://www.space.com/17605-**live-hd-video-between-planets-possible-soon-video**.html
http://www.space.com/17904-**a-ground-based-telescope-better-than-hubble-video**.html

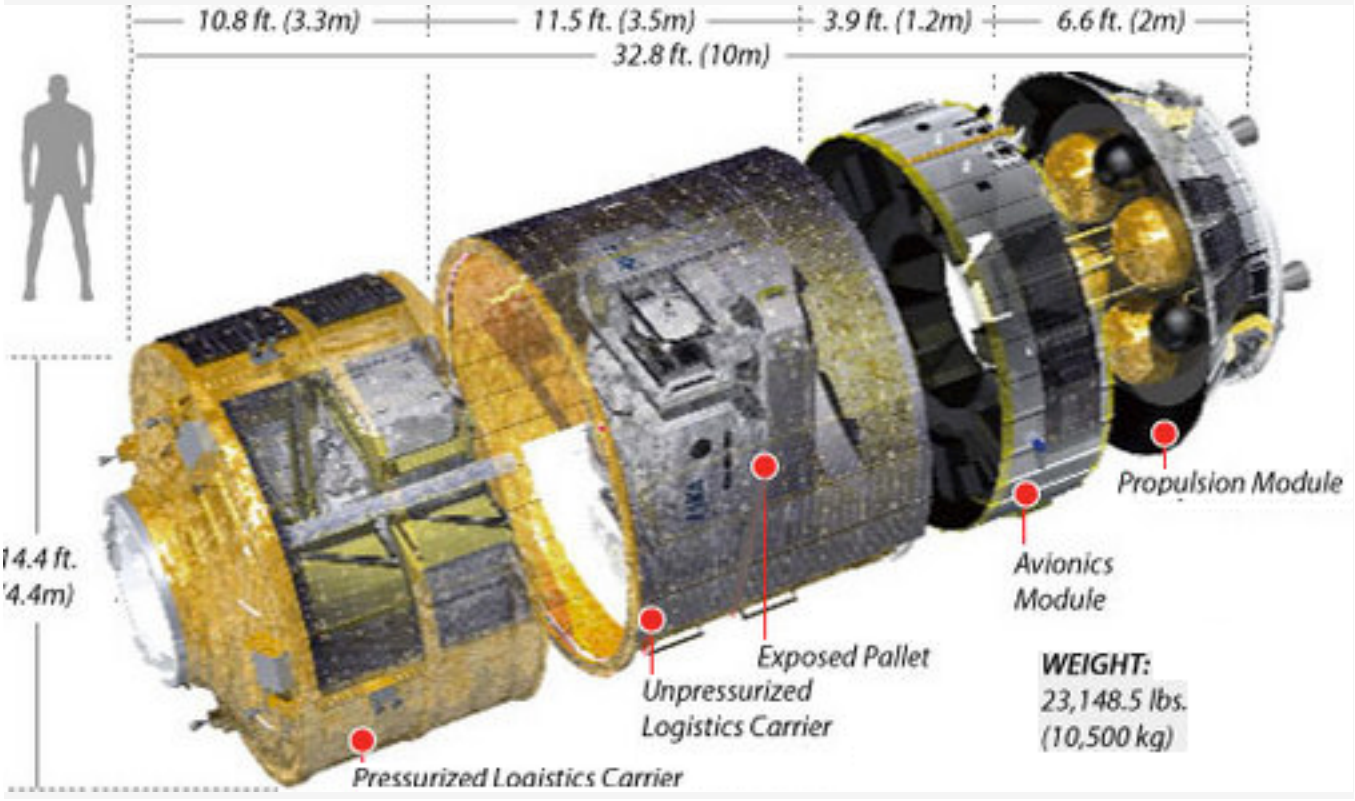
2007 to 2012 Sun Time-Lapse Video of our Sun's weather as it nears solar maximum
www.space.com/17660-**nearing-solar-maximum-incredible-2007-to-2012-sun-time-lapse-video**.html

Amazing Time-Lapse Video of Shuttle being mated to its Boeing 747 carrier
http://www.space.com/17658-**endeavour-and-747-mated-time-lapse-video**.html

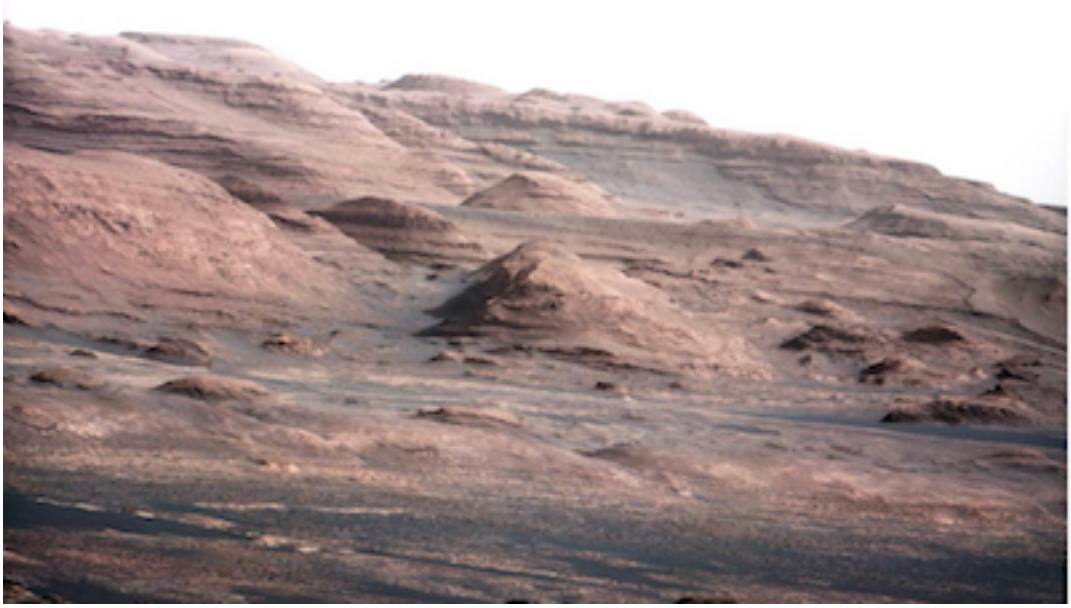
Dawn's top accomplishments at Vesta – http://www.nasa.gov/multimedia/videogallery/index.html?media_id=151669301

Talks from 15th Annual Mars Society Convention posted on YouTube
http://www.youtube.com/playlist?list=PL57B8D5FFF5B55A62&feature=view_all

TTSIQ PHOTO GALLERY



Space.com "infographic" on large Japanese H-II Cargo Carrier that supplies the International Space Station
http://en.wikipedia.org/wiki/H-II_Transfer_Vehicle

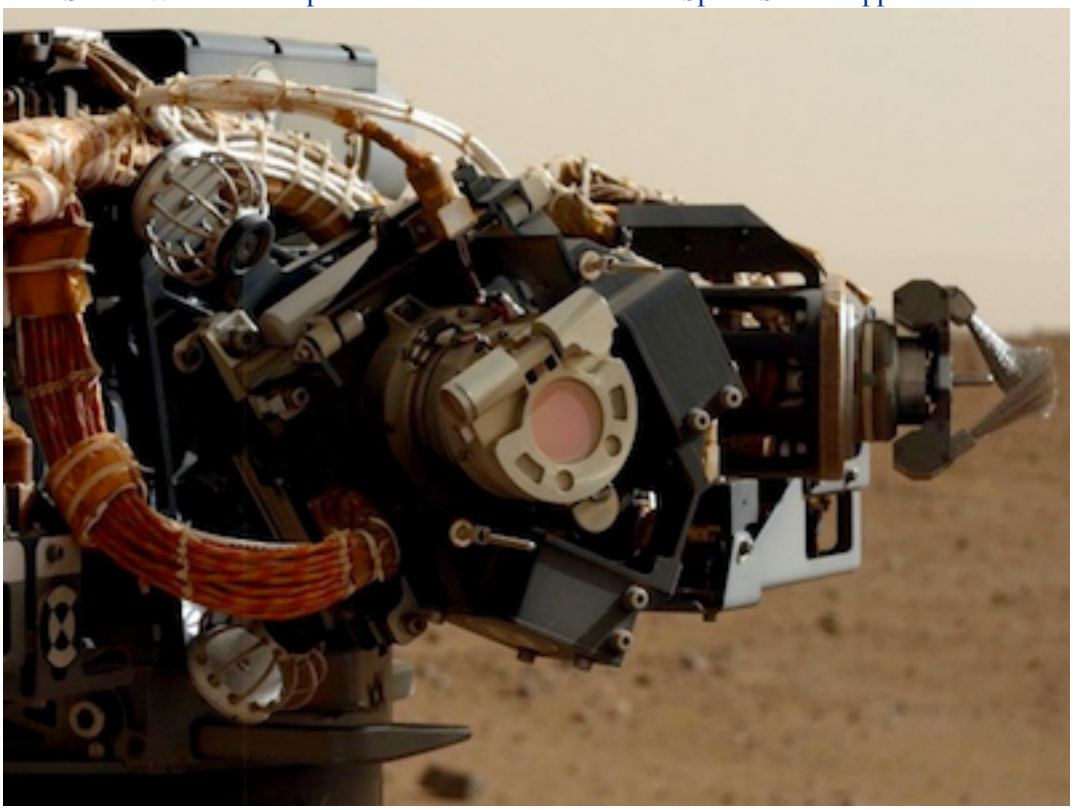


This photo from NASA's Mars rover Curiosity shows the layered geologic history of the base of **Mount Sharp**, the 5-km-high mountain rising from the center of Gale Crater. Image taken August 23, 2012. (NASA/JPL-Caltech/MSSS)
http://www.foxnews.com/scitech/2012/08/28/mars-rover-sends-human-voice-from-red-planet/#ixzz261GlpOWy

Curiosity snapped this mosaic photo of its own "wheels on the ground"
http://www.space.com/17538-mars-rover-curiosity-self-portrait-wheels.html

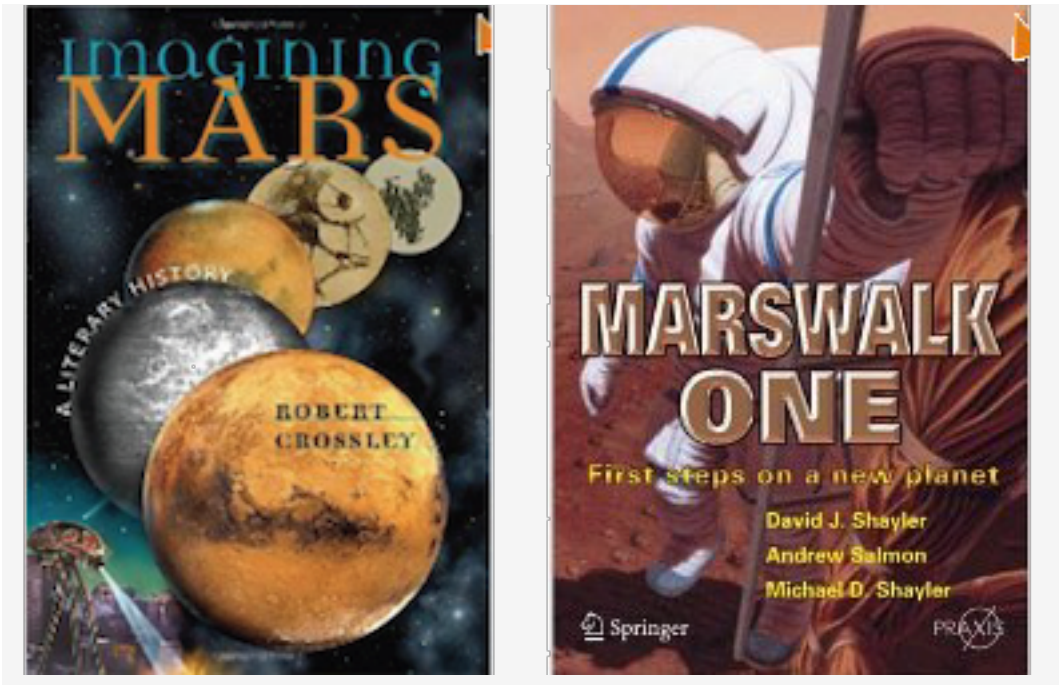
http://scitechdaily.com/images/**extensive-system-of-troughs-encircles-Vestas-equatorial-region**.jpg

Astronaut Sunita Williams on space walk outside International Space Station appears to touch the Sun



Curiosity self-portrait: One of Curiosity's cameras photographed by another - **Below:** 360° Mars panorama

Some Books THE book WORM on Mars



Left: Imagining Mars: A Literary History (Early Classics of Science Fiction)

(Hardcover) by Robert Crossley (Author) (January 2011)

"For centuries, the planet Mars has captivated astronomers and inspired writers of all genres. Whether imagined as the symbol of the bloody god of war, the cradle of an alien species or a possible new home for human civilization, our closest planetary neighbor has played a central role in how we think about ourselves in the universe. From Galileo to Kim Stanley Robinson, Robert Crossley traces the history of our fascination with the red planet as it has evolved in literature both fictional and scientific.

"Crossley focuses specifically on the interplay between scientific discovery and literary invention, exploring how writers throughout the ages have tried to assimilate or resist new planetary knowledge. Covering texts from the 1600s to the present, from the obscure to the classic, Crossley shows how writing about Mars has reflected the desires and social controversies of each era. This elegant study is perfect for science fiction fans and readers of popular science." Above review is quoted from http://www.aerospaceguide.net/spacebook/mars.html

Right: Marswalk One : First Steps on a New Planet (Paperback)

By David J. Shayler (Editor), Andrew Salmon (Editor), Michael D. Shayler (Editor) (August 2005)

"**Marswalk One** addresses the question of why we should embark on a journey to Mars, documenting what the first human crew will do when they place their feet in the red dust of the planet. The book also addresses why we need to carry out these tasks and, more importantly, what a human crew could achieve that an automated mission could not." (Springer Praxis Books / Space Exploration) http://www.aerospaceguide.net/spacebook/mars.html

On this site, **http://www.aerospaceguide.net/spacebook/mars.html** there are brief reviews of the above books and also of:

Mars 3-D: A Rover's-Eye View of the Red Planet by Jim Bell;

Planet Mars: Story of Another World by François Forget,

On to Mars 2: Exploring and Settling a New World by Dr. Frank Crossman,

Roving Mars: Spirit, Opportunity, and the Exploration of the Red Planet by Steve Squyres,

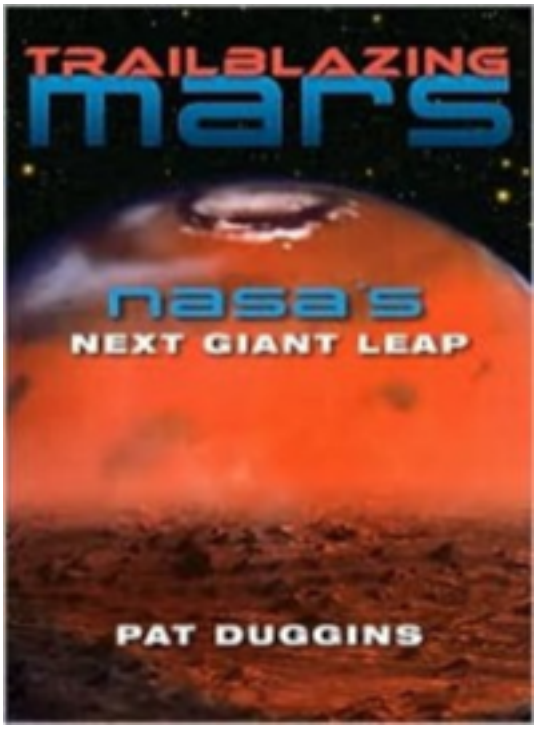
Magnificent Mars by Ken Crosswell,

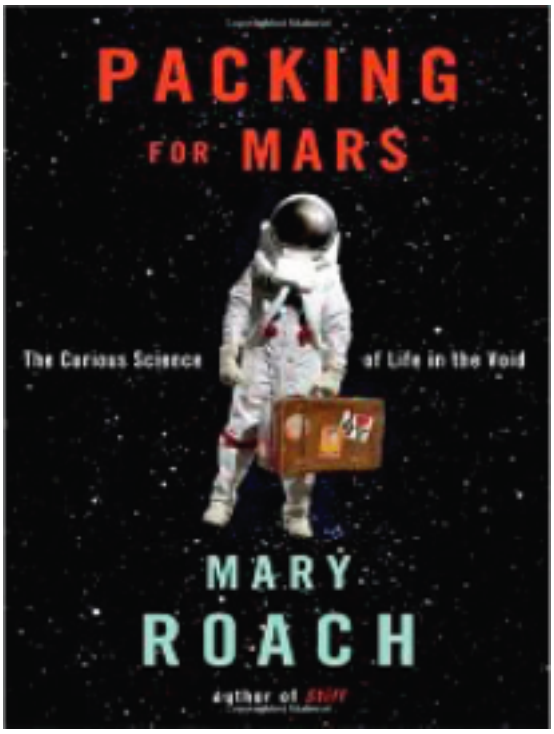
A Traveller's Guide to Mars: The Mysterious Landscapes of the Red Planet by William K. Hartman (highly recommended by M3IQ Editor Peter Kokh),

The Case for Mars: The Plan to Settle the Red Planet and Why We Must by Robert Zubrin,

Expedition Mars: How Are We Going to Get to Mars by Martin J. L. Turner,

Mars on Earth: The Adventures of Space Pioneers in the High Arctic by Robert Zubrin





Trailblazing Mars: NASA's Net Giant Leap By Pat Duggins

University Press of Florida, 2010 - hardcover, 224 pp., illus. - ISBN 978-0-8130-3518-5
http://www.amazon.com/Trailblazing-Mars-NASAs-Next-Giant/dp/081303518X/ref=sr_1_1?ie=UTF8&s=books&qid=1288717687&sr=1-1

Book Review: By Jeff Foust, Nov. 11, 2010. http://www.thespacereview.com/article/1717/1

Excerpt: "What technology, planning, and other preparation needed to be able to successfully mount human expeditions to the Red Planet is at the heart of Trailblazing Mars.

"Pat Duggins, a longtime National Public Radio reporter who covered the space program from Florida, digs through the history of space exploration as well as the various issues associated with the exploration of Mars. He takes on a broad range of issues in a relatively slender book, from the experience of building and working on the ISS to the biological and psychological lessons learned from the Biosphere 2 project in the early 1990s.

"He also examines some of the criticism for human Mars exploration from those who think such exploration is better done by robots and/or think NASA's priorities should be focused elsewhere, such as (in the opinion of Gregg Easterbrook) protecting the Earth from asteroid impacts."

"Given the book's subtitle and its timing, one might think that the book covers the shift in direction in space policy towards human Mars exploration that came earlier this year. Unfortunately, that's not the case:"

Excerpt from Amazon.com review: "The reader will be enlightened to find out that going to the moon and visiting Mars are not the same and why."

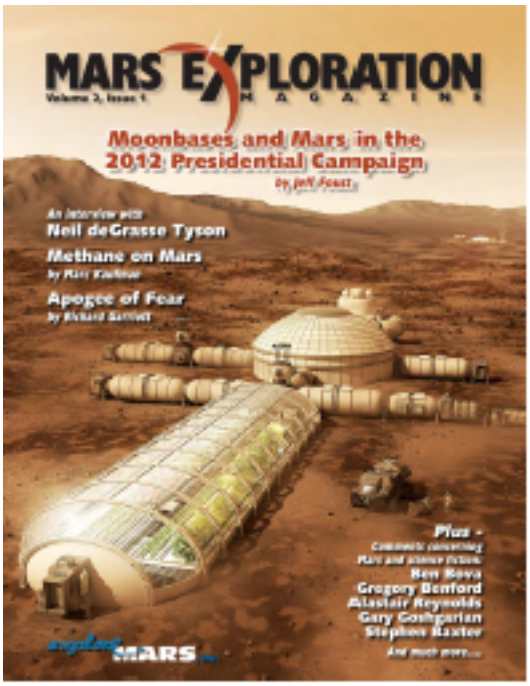
Packing for Mars: The Curious Science of Life in the Void By Mary Roach

W. Norton and Company, New York, London - ISBN 978-0-393-06847-4 (hardcover)

Reviews on this website http://www.amazon.com/Packing-Mars-Curious-Science-Life/dp/0393068471/ref=sr_1_2?ie=UTF8&s=books&qid=1288717750&sr=1-2

The author explores the irresistibly strange universe of space travel and life without gravity.

Space is a world devoid of the things we need to live and thrive: air, gravity, hot showers, fresh produce, privacy, beer. Space exploration is in some ways an exploration of what it means to be human. How much can a person give up? How much weirdness can they take? What happens to you when you can't walk for a year? have sex? smell flowers? What happens if you vomit in your helmet during a space walk? Is it possible for the human body to survive a bailout at 17,000 miles per hour? To answer these questions, space agencies set up all manner of quizzical and startlingly bizarre space simulations. As Mary Roach discovers, it's possible to preview space without ever leaving Earth. From the space shuttle training toilet to a crash test of NASA's new space capsule (cadaver filling in for astronaut), Roach takes us on a surreally entertaining trip into the science of life in space and space on Earth.



Mars-focused Online Publications

Mars Exploration Magazine is published by **ExploreMars.org** – you can read Volume 2, issue 1 online (software lets you flip the pages forward or backward) at http://www.exploremars.org/MEM_V2i1/index.html

More information including how to contribute an article: http://www.exploremars.org/mem – on this page you can access all 5 issues published to date by clicking on the cover image of each.

Additional ExploreMars.org links:

http://www.exploremars.org/page/mars-education-challenge
http://www.exploremars.org/page/isru-challenge
http://www.exploremars.org/page/mars-agriculture
http://www.exploremars.org/page/iss-mars – 2 ISS and Mars conferences to date
http://www.exploremars.org/page/women-and-mars
http://www.youtube.com/user/ExploreMarsinc/featured

The Mars Quarterly is published by **The Mars Society** – Volume 4, Issue 1(pictured above) can be read online at:
http://content.newmars.com/TMQ/TMQ-V4-I1.pdf – all issues at: http://content.newmars.com/TMQ/index.html
http://education.marssociety.org/home/recommended-reading
http://education.marssociety.org/home/links

Other Online Mars-focused sites and Resources

http://www.marsdrive.com – http://www.youtube.com/user/marsdrive
http://www.astrodigital.org/mars/
http://marsed.asu.edu/
http://www.nasa.gov/audience/foreducators/index.html
http://mars.jpl.nasa.gov/participate/marsforeducators/
http://www.google.com/mars/
http://www.moonsociety.org/mars/
http://www.moonsociety.org/publications/mmm_themes/mmmc_Mars1.pdf
http://www.moonsociety.org/publications/mmm_themes/mmmc_Mars2.pdf

More Mars-related Book Reviews

http://www.nss.org/resources/books/non_fiction/NF_097_marsresources.html
http://www.nss.org/resources/books/non_fiction/NF_067_passionformars.html
http://www.nss.org/resources/books/fiction/SF_026_howtoliveonmars.html

Moon Miners' Manifesto Resources

http://www.moonsociety.org/chapters/milwaukee/mmm/

MMM is published 10 times a year. The December 2012 issue will begin its 27th year of continuous publication.

Most issues deal with the **opening of the Lunar frontier**, suggesting how pioneers can use **local resources** and learn to **make themselves at home.** This will involve psychological, social, and physiological adjustment**.**

Some of the points made relate specifically to **pioneer life** in the lunar environment. But much of what holds for the Moon, will also hold true for **Mars and for space in general.** We have one Mars theme issue each year, and on occasion **other space destinations** are discussed: asteroids, Europa (Jupiter), Titan (Saturn), Venus, Mercury, etc.

Issues #145 (May 2001) forward through current are as pdf file downloads with a Moon Society username and password. For membership dues rates see **http://www.moonsociety.org/register/**

MMM Classics: All the "non-time-sensitive editorials and articles from past issues of MMM have been re-edited and republished in pdf files, one per publication year. A 3-year plus lag is kept between the MMM Classic volumes and the current issue. **As of December 2011, the first twenty-two years of MMM, 200 issues, will be preserved in this directory,** These issues are freely accessible to all, no username or password needed, at:

www.moonsocietyorg/publications/mmm_classics/

MMM Classic Theme Issues: introduced a new series to collect the same material as in the Classics, but this time organized by theme. The first MMM Classic Theme issue gathers all the **Mars** theme articles from years 1-10 in one pdf file. A second pdf file collects all the Mars Theme issues from year 11-20. The 2nd Classic Theme is "**Eden on Luna**," addressing environmental issues underlying lunar settlement. **Asteroids**, **Tourism, Research**, **Select Editorials, Analog Programs**, **Arts &** Crafts**,** and **The Cislunar Economy** have been added. New Theme Issues will include: Architecture & Building Materials, Modular Biospherics, Other Solar System Destinations, and so on.

www.moonsociety.org/publications/mmm_themes/

MMM Glossary: The publishers of MMM, the Lunar Reclamation Society, has published a new Glossary of "MMM-Speak: new words and old wordsmith new meaning" as used in Moon Miners' Manifesto.

www.moonsociety.org/publications/m3glossary.html The initial edition includes over 300 entries, many with illustrations. Additional entries are under construction. It is hoped that new members will consider this to be a "Read Me First" guide, not just to Moon Miners' Manifesto, but to our vision and goals.

All of these resources are available online or as free access downloads to readers. But TTSIQ does need your help!

To The Stars International Quarterly Advisors, Liaisons, Contributors, Correspondents, Illustrators, etc.
Writers, Artists, Teachers, and Students are all welcome to contriubte. **Make this publication yours!**

If this publication is to help spread the word about Space worldwide, among the public at large, especially among the students and younger people, it must become a truly International publication. We need people from many fields or research, education, media, and outreach to join our team

If you think that you can add to the usefulness and vitality of this publication, in any of the ways listed above, or in fields we had not thought of, write us at: ttsiq@moonsociety.org [This address goes to the whole editorial team]

Tell us about yourself; your interest in space, and how you think you can make this publication of real service in the education of the public anywhere in the world, and in the education of young people on whom the future of India and the world will rest.

Guidelines for Submissions: TTSIQ is intended for wide public distribution to encourage support for space research and exploration and development. TTSIQ is not a scholarly review or a technical journal for professional distribution. Submissions should be short, no more than a few thousand words at most. Longer pieces may be serialized editorials and commentary, reports on actual developments and proposals, glimpses of life on the future space frontier, etc. Articles about launch vehicles and launch facilities, space destinations such as Earth Orbit, The Moon, Mars, the asteroids, and beyond, challenges such as moondust, radiation, reduced gravity, and more.

Help Circulate To The Stars International Quarterly

If you know someone who might enjoy reading this publication, send us their email address(es) so that they receive notice when a new issue if published. Readers are encouraged to share and to distribute these issues widely, either as email attachments, or via the direct download address (for all issues): http://www.nss.org/news/ttsiq/

TTSIQ will remain a free publication. Our intended publication schedule is **January, April, July, October**

Upcoming Conferences & Events – http://www.spacecalendar.com/downrange/

----- 2012 -----

Oct 25-27 — **ESA, International Assoc. of Sedimentologists,** Marrakech, Morocco: Terrestrial Mars Analogues
Nov 4-11 — **Association of Space Explorers**, Riyadh, Saudi Arabia: 'The 25th ASE Planetary Congress.'
Nov 8-11 — **Students for the Exploration & Development of Space (SEDS)**, Buffalo, NY: 'SEDS SpaceVision 2012 Conference: Crossroads – How Our Generation Will Take Us To The Space Frontier.'
Nov 11-15 — **Pacific International Space Center for Exploration Systems (PISCES)**, Waikoloa, HI: '2012 PISCES Symposium: Pioneering Sustainable Settlements Beyond Low-Earth Orbit.'
Dec 1 — **Space Tourism Society**, Los Angeles, CA: 'Seminar: Space Experience Economy (SEE).'
Dec 11-14 — **Asia-Pacific Regional Space Agency Forum (APRSAF)**, Kuala Lumpur, Malaysia: 19th annual meeting
Dec 31 — **X Prize Foundation**, Santa Monica, CA:Deadline for full $20 M prize, thereafter $15 M

-----2013 -----

Mar 5-7 — **International Space University**, Strasbourg, France: 17th ISU Annual International Symposium: 'Space Technology and Tele-Reach: Benefiting Humanity on Earth and Beyond.'
Mid-2013 — **NASA, ESA, Launch Lunar Atmosphere and Dust Environment Explorer (LADEE) / Minotaur V**, Wallops Island VA: 160 day mission to Moon to transmit laser signals to NASA stations around the world
Apr 15-19 — **IAA, NASA, ESA**, Flagstaff AZ: '2013 IAA Planetary Defense Conference.'
May 23-27 — **The National Space Society**, San Diego CA: '32nd Annual International Space Development Conference.' Moon Society to host Track on Lunar Lava Tubes
Nov — **ISRO, Launch PSLV / Mars Orbiter**, India: Orbiter carrying 25 kg of scientific payloads to Mars.

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