AIAA American Institute of Aeronautics and Astronautics Los Angeles - Las Vegas Section

Newsletter

June 2020

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Cultural Significance of Our Moon

by Madhu Thangavelu, Faculty Member, USC/ISU

An artistic collage impression of our beloved Moon. [credit Palos Verdes Pulse]

Our Moon, the moon of planet Earth, is special. The fifth largest moon in our solar system, our Moon is an old soul sister of planet Earth. She has been in orbit around the Earth since the time the early solar system took shape. Our Moon was born in a fiery tangle between a Mars-sized object and Earth, during the early period, when our solar system looked more like a free-for-all shooting gallery with bullets the size of planets whizzing around, and no sheriff in charge. She has been slowly tamed and nurtured over four and a half billion years, and now, literally embraced in a waltz that we call tidal locking, with her face toward mother Earth.

The evolution of planet Earth and life are inextricably linked to our Moon. Our biosphere and our species evolved as our Moon orbited our planet. Recurring geological phenomena, tidal and seasonal patterns, biorhythms are all suspect to, or have been attributed to lunar orbital motions. Even the stability of the Earth's axis has been attributed to our Moon, allowing slow and steady evolution to happen on our blue planet.

Our Moon is one of the first objects that our children recognize and repeat (to inform us of their ability to observe, discern and recollect, perhaps?) as they train their eyes on the closest, brightest disc that adorns our night skies. Perhaps the innate, deep-seated, cross-cultural and transcendental emotions of Wonder and Awe are ignited during those formative years?

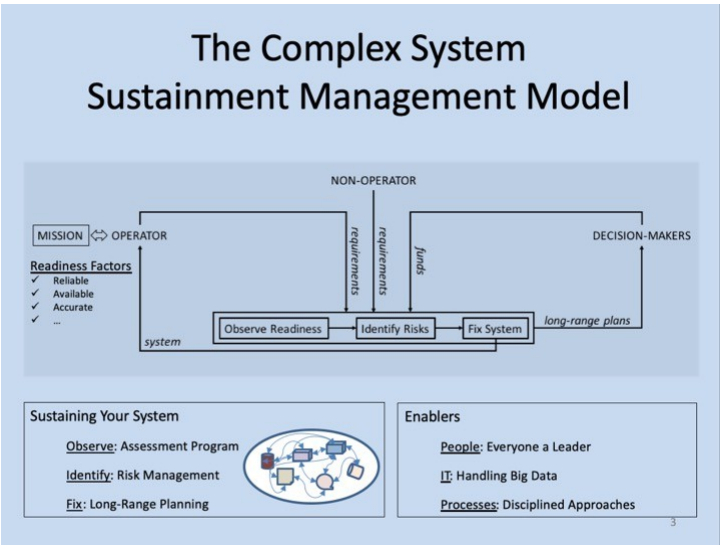
Our Moon is an easy and rich target for beginner astronomy and astrophotography students. This photo was shot through the eyepiece of a small 10 inch Dobsonian telescope with a handheld iphone, October 2019. (Photo Courtesy: Madhu Thangavelu)

(Continued on Page 15)

https://www.palosverdespulse.com/blog/2020/5/27/cultural-significance-of-our-moon-by-mthangavelu (Authorized by the article author and Palos Verdes Pulse)

A Useful Model, Readiness Factors, and Some Definitions

by Col. Charles Vono (USAF & TRW Retired), AIAA Distinguished Lecturer, AIAA Associate Fellow



Complex System Sustainment Management Model. (CSSMM). (Chart Courtesy of Charles Vono)

This is the second in a series of newsletter articles that…

- describes the approach for effective and affordable sustainment (from ICBMs)
- how ICBM sustainers fit that solution into one integrated sustainment management system
- what these solutions mean for all of us today as we struggle with the very same problems

The figure that goes with this article represents a management model for complex system sustainment. You can find my various AIAA papers and presentations on this subject at my web site, charlesvono.com/ "Presentations and Publications". The version of the model I write about is the Complex System Sustainment Management Model (CSSMM).

In its barest bones, this management model observes the complete system to find emerging failure modes so that a prioritized list of risk mitigations can be sold to the USAF decision-makers that hold the purse-strings. As mentioned in the last article, readiness factors help with the observation and creation of sustainment risk statements.

The readiness factors that were important to the Strategic Air Command were availability, reliability, accuracy, hardness from attack, safety, and surety.

When USAF ICBM people discuss reliability and availability readiness factors versus the USAF aircraft folks some interesting differences appear. First of all, the expected reliability of a rocket buried in a remote location in a northern snowfield will necessarily need to be much higher than an aircraft that is easily accessible for maintenance. Similarly, ICBMs are immediately available (thus, the name, Minuteman), while aircraft may be given a period of time to generate a sortie. Many consider the safe and sure use of a nuclear weapon delivery system to be a part of availability since a system which is not safe or not secure would not be allowed to be available. Lack of hardness against attack would not support the deterrence mission since it would encourage a first strike. In keeping with national policy, the system needs to have a certain level of accuracy such that it can be targeted against specific military targets and not just large cities. Interestingly, it does not have a requirement to be any more accurate than that.

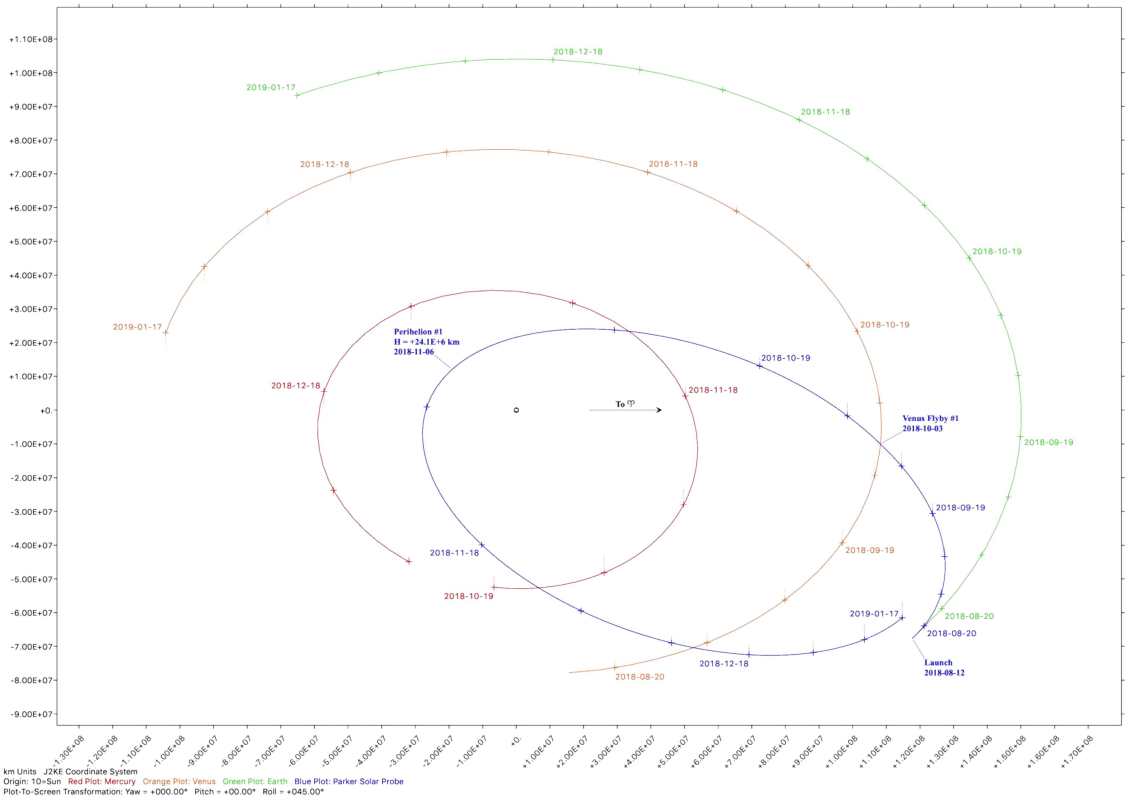
ICBM readiness factors have precise definitions. For instance, reliability applies after the launch command is issued. Hardness against radiation is different than similar requirements for recon satellites. These precise definitions turn out to be very useful when assessing risks. Your system should have precise definitions of your readiness factors too.

What I have observed in ICBMs also should happen in your team: There is a willingness of ICBM sustainers and sustainment managers to constantly revisit these precise definitions to make sure they are still supporting the needs of sustainment management. These kinds of deep-probing questions usually arise when debating a particular set of expected risks to the system."Why is this a risk to availability? Are we sure this fits the definition?

(Continued on Page 16)

Parker Solar Probe Odyssey

by Daniel R. Adamo (Astrodynamics Consultant, NASA-JSC Retired), AIAA Distinguished Lecturer & Associate Fellow (adamod@earthlink.net) 21 September 2019 (Authorized by the author)



Trajectories (2018-08-12 to 2019-01-17) of the Parker Solar Probe (PSP, Blue Color), Mercury (Red Color), Venus (Orange Color) and Earth (Green Color) (Courtesy of Daniel R. Adamo) (Please enlarge to see more details.)

This document contains an orbit-by-orbit account of as-flown heliocentric motion for the Parker Solar Probe (PSP), ending with a short excursion into planned future motion. The PSP launch was on 12 August 2018 at 07:31 UT atop a Delta IV-Heavy with upperstage. Through a series of 7 Venus flybys extending over 24 heliocentric orbits, PSP's perihelion height will be lowered from +30.4 million km to within +6.2 million km (about 10 solar radii above the Sun's surface) when the planned mission ends in mid-2025.

These closest-ever approaches to the Sun will permit *in situ* study of the Sun's corona and phenomena heating it to 1.7 million degreesC. During perihelion passages, PSP's heat shield will reach temperatures exceeding 1300 degrees C. Thermal and convective energies within the corona are thought to give rise to the solar wind, and understanding the associated processes is a major PSP mission objective.

Trajectory data for the ensuing plots are downloaded from JPL's *Horizons* ephemeris server at https://ssd.jpl.nasa.gov/?horizons (accessed 21 September, 2019). Events for PSP are obtained from http://parkersolarprobe.jhuapl.edu/The-Mission/index.php#Timeline (accessed 21 September, 2019). Dates pertaining to these events reflect UT such that an one falling on 3 October 2018 at 23:00 UT would be annotated as "2018-10-03" on a plot.

Each PSP plot (in **blue**) is marked by "+" time ticks at 00:00 UT every 10 days, as are accompanying plots for Mercury (in **red**), Venus (in **orange**), and Earth (in **green**). Every 30 days along a particular plot, a time tick is annotated with the corresponding calendar date in "YYYY-MM-DD" format. The PSP, Venus, and Earth plots span a time interval just short of the current PSP orbit period. Because this period exceeds that of Mercury, a shorter interval is selected to plot the innermost planet's orbit and avoid overlapping ambiguities. In general, a Mercury plotting interval includes the corresponding PSP perihelion epoch.

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Getting A Fix on How GPS Came To Be with Frank Czopek

By Douglass M. Stewart, Jr., Producer/Writer/Director - "Chesley Bonestell: A Brush With The Future"

aiaa-lalv.org/may-9-2020-e-town-hall-meeting-with-guest-speakers-maureen-zappala-and-frank-czopek/

NAVSTAR GPS logo. (from Wikipedia)

When it comes to navigating the planet today, be it on land, at sea, up in the air or in outer space, it's mandatory to know where exactly you are. These days, it's extremely simple to do that - your GPS device will tell you all you need to know, right? True, but it hasn't always been that easy. The history of navigational tools includes compasses, sextants, maps, charts, and even lighthouses. World War II introduced an electronic device called LORAN (Long Range Navigation), which used a radio signal to calculate one's position. No matter what was used, however, the results were not always reliable, even sometimes catastrophic. Navigators yearned for precision but were fortunate if they got it. After World War II, military navigational needs began to require greater accuracy. It was the development of the Polaris nuclear missile program that prompted the call for a better, more precise way to navigate the globe. This led to what eventually became the Global Positioning Satellite system. Essentially, it's a unique constellation of spacecraft in orbit that are used to pinpoint the location of any specialized receiver with tremendous accuracy, anywhere in the world.

The uses of GPS have become almost uncountable and it makes you wonder how we got along before its implementation in everything from rockets to automobiles to cell phones. In a stunning and fascinating two-hour webinar presentation, **Frank Czopek**, an unofficial GPS historian, and a former manager of a GPS program in Southern California, recounted the dramatic story of how the Global Positioning Satellite system came to be. Although the first satellite deployed in this program went up in 1978, Frank points out that its history includes these disparate historical events:

-The Slovakian independence movement of 1918
-The development of Radar in the 1940's
-The radio signal sent down by Russia's Sputnik satellite in 1957
-The AC 130 gunship in the Vietnam War
- The re-election of Richard Nixon in 1972

With unshakeable certainty, Frank posits: "If any of those things didn't happen, we wouldn't have GPS today." But they did and what a tale he tells.

In the 1960's, each branch of our Armed Forces could see the need for a GPS-type system. Coming up with something that satisfied all the requirements of the Army, the Navy and the Air Force at the same time was a seemingly impossible task. What's it going to cost? Who's paying for it? Who's going to build it? Who's going to run it? Turf and political battles abounded… heroes and villains emerged. There were twists and turns that continually put the GPS proposal in peril. On Labor Day, 1973, GPS was given a unanimous "go" by all three military branches and Frank takes you into the offices and boardrooms to explain who the key players were and what it finally took to get this now invaluable global navigation system up and operational. It's a breathtaking account of the creation of something miraculous, which itself, took miracles to make happen.. So what did the Slovakian Independence movement of 1918 have to do with an orbiting navigation system that also keeps an eye out for nuclear explosions? While we are coping with COVID-19, you can find out in the story of this amazing American accomplishment at this link:
https://www.youtube.com/watch?v=ACNbVlsNLto&t=2685s

For a further perspective on this subject, you can also check out "Cosmic GPS" by Adam Hadhazy in the May 2020 issue of the AIAA's magazine ***Aerospace America*** Available in print or electronically at https://aerospaceamerica.aiaa.org/features/cosmic-gps/

Introduction to Space Architecture

by Anastasia Prosina, Founder & CEO at Stellar Amenities, Award-winning aspirational futurist and practitioner in Space Architecture (31 May, 2020, with Permission from the author) stellaramenities.space/introduction-to-space-architecture

On the 30th of May 2020, SpaceX launched people to space for the first time. It marks the beginning of the new era of space exploration where we all going to see dozens of civilians traveling to space just in this decade. As it comes down to expansion, we need to make sure our isolation in space does not cause mental and physiological problems. Is it time for space architects to stand out?

Introduction to Space Architecture

First, let's define what architecture is. Architecture is the art and science of designing buildings and other physical structures. Space Architecture is a part of Architecture, sharing the niche of small architecture among tiny housing, small living apartments/houses, vehicle design, capsule hotels, and more (Figure 1)

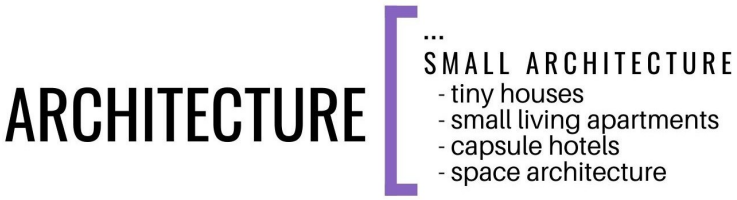


Fig. 1. Space Architecture within Architecture

The principles of a successful design for a small space habitat don't differ from other design principles applied to the variety of small living on Earth. They all aim to be multifunctional and mitigate the sensory deprivation of existing in a small space.

The processes of creating architecture and space architecture are different (Fig. 2). In architecture, the vision of an architect comes first, and then an engineer helps this vision become a reality. In space architecture, the process starts with a group of engineers who design and assemble the spacecraft, outfitted with the necessary systems. A space architect comes afterwards to help design for the human needs in the confined environment.

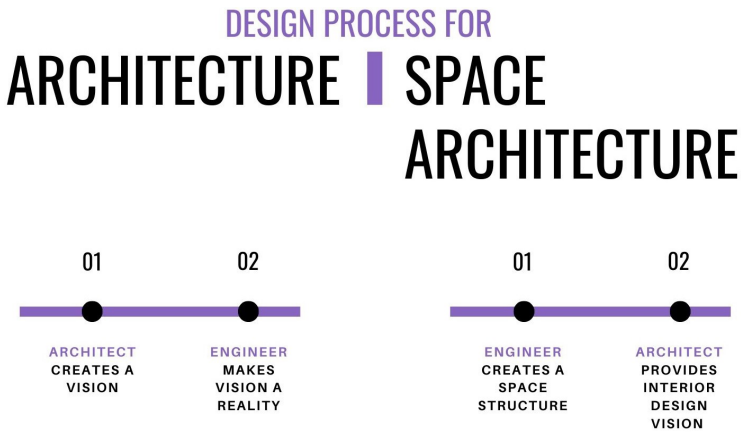
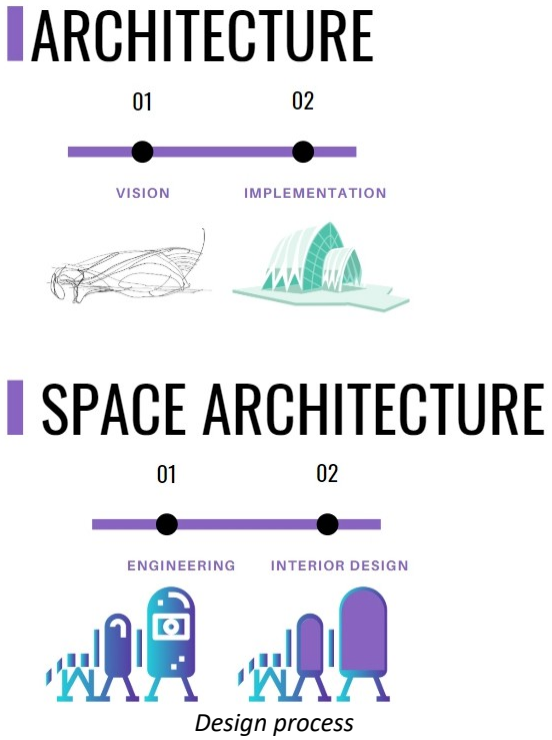


Fig. 2. The design process in Architecture and Space Architecture

Although architects are creative and visionary, they are rarely so radical that they design structures that couldn't be built with modern engineering. Certainly, they always sacrifice some of their vision to the necessities of engineering, yet architects have an intuition about what's physically feasible.



Design process

In contrast, the spaceflight industry has strict requirements because a spacecraft is such an extensive system of interdependencies that cannot be changed. Seeing the engineering constraints first is much more efficient for a space architect. He or she can then work within those constraints rather than implement the vision and then work with an aerospace engineer to see if this

(Continued on Page 18)

Astrobotic Awarded $199.5 Million Contract to Deliver NASA Moon Rover *(11 June, 2020)*

by Astrobotic Technology, Inc. (with Permission)

Astrobotic's Griffin lunar lander to carry the NASA VIPER mission to the south pole of the Moon in 2023, as a precursor to a human landing

Pittsburgh, PA – Astrobotic, the world's leading lunar logistics service provider, has been selected by NASA to deliver the Volatiles Investigating Polar Exploration Rover, or VIPER, to the south pole of the Moon in 2023.

Astrobotic will provide an end-to-end delivery for VIPER on board the company's Griffin lunar lander through a $199.5 million contract awarded under the NASA Commercial Lunar Payload Services program, or CLPS. Griffin's delivery of VIPER will be Astrobotic's second CLPS delivery, following the company's Peregrine lander delivery in 2021. In addition, Astrobotic's MoonRanger rover was previously selected by NASA for delivery to the Moon in 2022 on the lander of another CLPS partner.

The Griffin lunar lander is Astrobotic's medium capacity lander product line, and is capable of delivering up to 500 kg of mass to the lunar surface. Griffin uses many of the same subsystems and approaches employed by the Peregrine lander, which will fly two years before VIPER. Both lander product lines put a heavy emphasis on safe and reliable delivery of customer payloads to the Moon.

When VIPER disembarks from Griffin's ramps onto the Moon, it will survey the surface and subsurface for water ice, which could be used for breathable air and rocket propellant by future deep space explorers. VIPER's mapping of lunar water ice could be the first step toward utilizing resources in the space environment – rather than carting them all from Earth – to enable more affordable and sustainable space exploration.

"It is an enormous honor and responsibility to be chosen by NASA to deliver this mission of national importance," said Astrobotic CEO John Thornton. "Astrobotic's lunar logistics services were created to open a new era on the Moon. Delivering VIPER to look for water and setting the stage for the first human crew since Apollo embodies our mission as a company."

A press kit with photos and animations of Griffin and VIPER can be found here.

About Astrobotic

Astrobotic Technology, Inc. is a space robotics company that seeks to make space accessible to the world. Their lunar landers and rovers deliver payloads to the Moon for companies, governments, universities, non-profits, and individuals. They are also developing advanced space robotics capabilities such as terrain relative navigation, mobile robotics for lunar surface operations, and reliable computing systems for mission-critical applications. The company has more than 30 prior and ongoing NASA and commercial technology contracts and a corporate sponsorship with DHL. Astrobotic was founded in 2007 and is headquartered in Pittsburgh, PA.

Mr. John Thornton will be speaking with us on July 11, 2020 in our AIAA LA-LV e-Town Hall Meeting (conta.cc/2Y9nZB0). Also see page 35 of this newsletter.

Astrobotic Awarded NASA Contract to Develop UltraNav Smart Camera for Next-Generation Space Missions *(3 June, 2020)*

by Astrobotic Technology, Inc. (with Permission)

Astrobotic's UltraNav Aims to make Advanced Vision-Based Navigation Accessible to the Broader Space Industry

Pittsburgh, PA – NASA has selected Astrobotic for a Small Business Innovation Research (SBIR) Phase II award to continue its development of UltraNav, a low-cost, autonomous, visual navigation system for spacecraft. The system has wide-ranging applications, from the servicing of Earth satellites to journeys to challenging space destinations such as the lunar poles or Martian mountains.

UltraNav, short for Ultra-Compact Standalone Visual Relative Navigation, consists of a high-quality compact camera with a built-in computer carrying a proven suite of accelerated computer vision algorithms. The system is optimized for space applications such as rendezvous and docking, precision planetary landing, and autonomous rover navigation. It can be packaged as a stand-alone sensor or part of a larger navigation system, customized with mission-specific algorithms, and integrated with a wide variety of spacecraft types, from tiny CubeSats all the way up to large human landers.

The visual navigation provided by UltraNav is critical for modern spacecraft operating at destinations beyond the reach of GPS, such as the Moon and deep space. In these settings, vision-based techniques can be used instead of GPS to accurately pinpoint a spacecraft's location. Even when GPS is available, visual navigation can ensure safety in critical maneuvers, such as those in the vicinity of other spacecraft.

UltraNav performs visual navigation by taking pictures of the spacecraft's surroundings, which may include a neighboring spacecraft or a planetary surface. Its algorithms then recognize features in those images and match them to preloaded maps with known dimensions. This in turn is used to calculate the spacecraft's location relative to those features. As the spacecraft moves, so do the positions of the features in the images, enabling tracking of the spacecraft's motion.

UltraNav is designed with a small size, weight, power consumption, and cost for the purpose of making advanced visual navigation and perception accessible to the broader commercial and low-budget space mission market. Traditionally, spacecraft with visual sensors require costly development to integrate disparate cameras, computers, and image processing software, limiting the use of these advanced technologies primarily to high-budget, flagship missions.

"UltraNav builds on Astrobotic's prior work developing inexpensive, reliable, and easy-to-use visual navigation tools, and demonstrates our expertise in navigation and landing in GPS-denied applications," said Chris Owens, Principal Investigator of the UltraNav program. "With the help of NASA SBIR funding, we will continue to develop a compact visual space navigation system for use by small satellites, lunar landers, and surface rovers."

In addition to selling or licensing UltraNav to other spacecraft developers and companies, Astrobotic will use the technology for its own upcoming missions and vehicles, such as precision landing for its Peregrine lunar lander and visual navigation for its CubeRover and Polaris rovers.

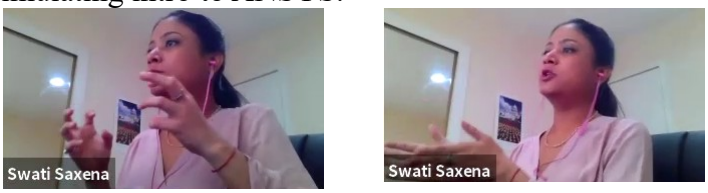
Astrobotic's UltraNav contract, valued at $750,000 over two years, is part of the NASA SBIR program's annual investment in U.S. small businesses with promising new technologies whose benefits are strongly aligned with NASA's future goals. The award will enable Astrobotic to continue and build upon the successful work performed on UltraNav under its prior NASA SBIR Phase I contract.

AIAA Los Angeles – Las Vegas June 6, 2020 eTown Hall

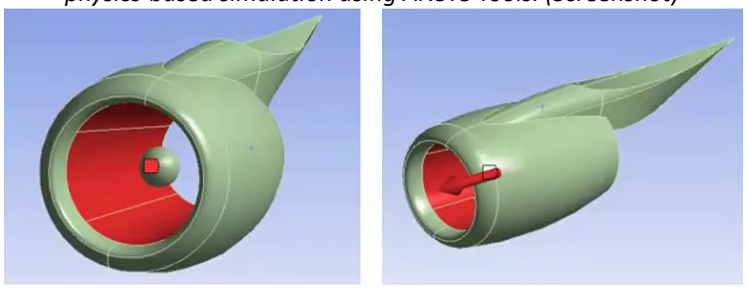
by Jim Kowalski, AIAA LV-LV Council Member, Career and Workforce Development Chair
Electronics Consultant and Reliability Analyst, former NASA - JPL Avionics & Communications Engineer

On Saturday, June 6, 2020, we had two presentations: **1. Swati Saxena, Ph.D.**, "*ANSYS, Innovation through Simulation*". **2. Michael Staab**, Northrup Grummann, formerly of JPL, "*The Cassini Mission*".

Swati Saxena is Technical and Program Manager at ANSYS. She demonstrated simulation capabilities of the tool, illustrating the steps with a aircraft fluid dynamics model. The tool is widely applicable from econometrics to 3-D meshes, for mechanical stress analysis, semiconductors, and optics, to name a few. ANSYS will integrate with existing MatLab modes, easing elaboration of heritage designs. Swati is an AIAA Council member of the San Francisco Section. We thank her for the stimulating intro to ANSYS.



Dr. Swati Saxena vividly explaining the beauty and capabilities of physics-based simulation using ANSYS Tools. (Screenshot)

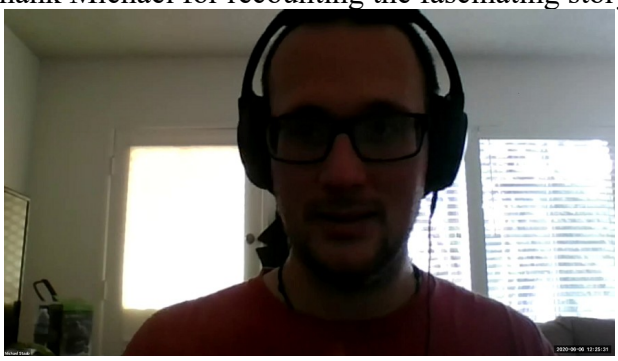


Static Structural Analysis as an example of modeling. (Screenshot)

Michael Staab spoke of the mission development at JPL, describing competed and flagship NASA missions. He work on operations for the Cassini Mission, and described the massive scope of the project, which involved much of JPL's resources in the '90s. Launched on Oct. 15, 1997, Cassini achieved orbit insertion around Saturn on July 1, 2004. The trajectory used gravity assist, a technique of stealing some energy by dipping into the gravity well of a bypassing body, and sling-shotting out in a new path. There were four gravity-assists from Venus, Earth and Jupiter flybys on the way to Saturn. A wealth of scientific data was gleaned from Cassini. Its piggyback Huygens craft descended through the atmosphere of Saturn moon Titan to the icy surface on January 14, 2005, radioing back telemetry to Cassini for 90 minutes. The data was then relayed to Earth.

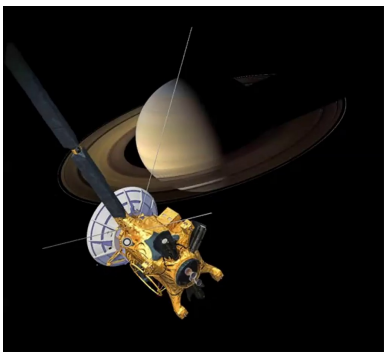
Cassini spent many years exploring Saturn, its moons and its rings. It was destroyed when all resources were almost exhausted, doing a final orbit maneuver to enter the Saturn atmosphere and burn up on Sept. 15, 2017.

We thank Michael for recounting the fascinating story.



Michael Staab, the speaker, sharing his experiences in the Cassini Mission and the future exploration. (Screenshot)

Saturn Rings, including the E/G rings. (Screenshot)



The Grand Finale. (Portrait, Screenshot)

About the Author:
James Kowalski designed telecomunications and avionics at JPL from 1991 to 2010. Prior to that he worked in semiconductors and computer design. Since JPL, he's been an electronics consultant and reliability analyst.

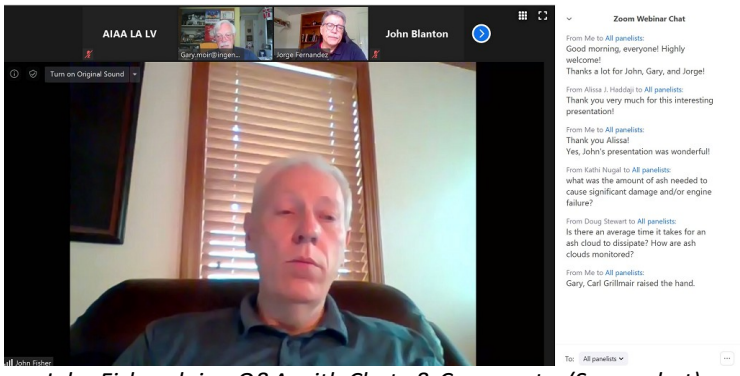
Volcanic Ash and Aviation by John Fisher (28 May, 2020) *(Photos Only)*

(No recording was made for this event. Only a few screenshots for the purpose of this newsletter.)

The speaker outlining his presentation of the day. (Screenshot)

Mt. Eyjafjallajokull Eruption in Iceland in 2010. (From Gary Moir)

The speaker, John Fish, explaining the damages of the volcanic ashes s on engines. (Screenshot)



John Fisher doing Q&A with Chats & Comments. (Screenshot)

Jorge Fernandez, a colleague of John Fisher in FAA, making comments and add more points. (Screenshot)

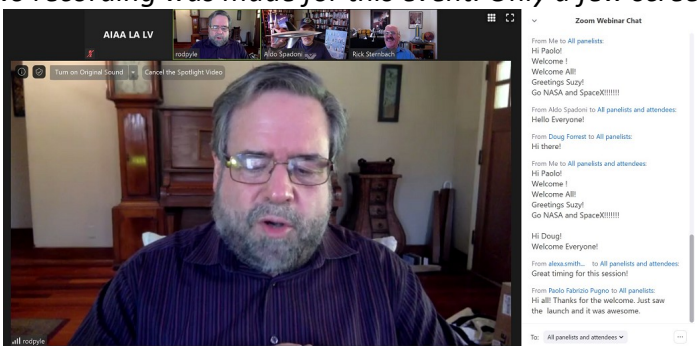
John Blanton making comments on the talk.- No, he was not joining from the ISS. It was the virtual background! (Screenshot)

Gary Moir moderated this event and made very goodcomments about the presentation and topic. (Screenshot)

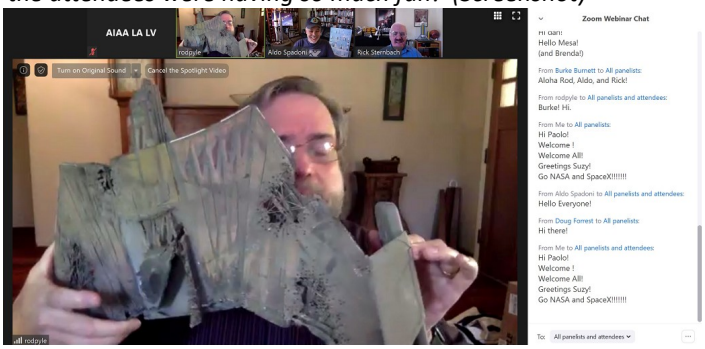
John Fisher
Senior Technical Specialist (STS) for Aircraft Icing
(Courtesy of John Fisher)

Spacecraft in Science Fiction with the Three Spacecateers Rod Pyle, Aldo Spadoni, and Rick Sternbach (30 May, 2020) *(Photos Only)*

(No recording was made for this event. Only a few screenshots for the purpose of this newsletter.)



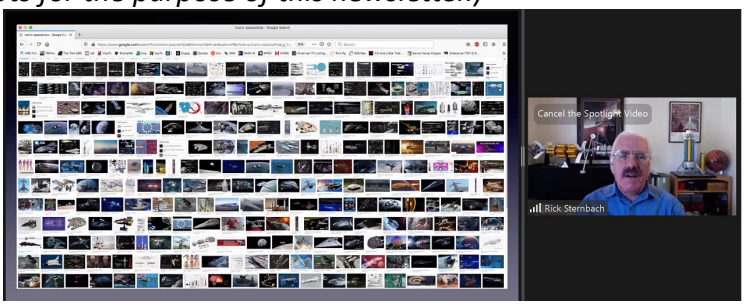
Rod Pyle starting & moderating the event. The Three Spacecateers & the attendees were having so much fun! (Screenshot)



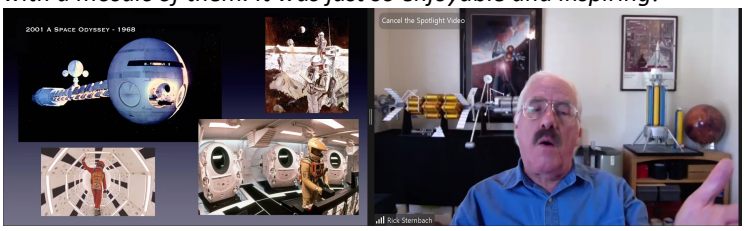
RRod Pyle sharing a model of a Klingon spacecraft used in "Star Trek: Deep Space Nine," on which he worked for three seasons.

Elon Musk and SpaceX Crew Dragon were mentioned, as just 30 min before the event on May 30, the DM-2 (with 2 astronauts) was launched successfully. Catching the tide and trends! (Screenshot)

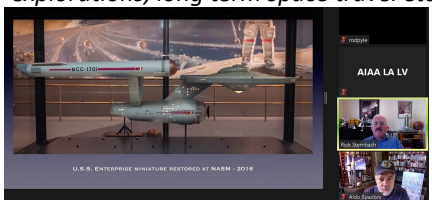
Aldo Spadoni having so much fun sharing his aerospace and Hollywood Sci-Fi spacecraft designing career! (Screenshot)



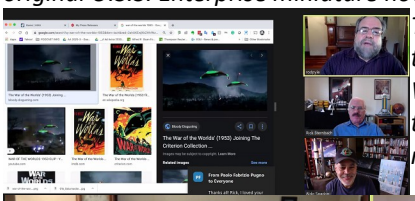
Rick Sternbach talking about the many Sci-Fi spacecraft designs with a mosaic of them. It was just so enjoyable and inspiring!



Rick Sternbach talking about the inspiring designs in the epic classic 2001: A Space Odyssey (1968) and the related designs of the interiors, lunar explorations, long term space travel etc.



Rick Sternbach talking about the many sci-fi spacecraft he designed or participated in designing, as well as the restoration of the original U.S.S. Enterprise miniature now on display at the NASM.



The Three Spacecateers talking about the classic "The War of the Worlds (1953)", the original of several remakes.. (Screenshot)

The Three Spacecateers! One for All, All for One! What an exciting day with this informative event and the historic SpaceX Crew Dragon DM-2 (Endeavour) launch with Bob and Doug, back to back ! (Screenshot)

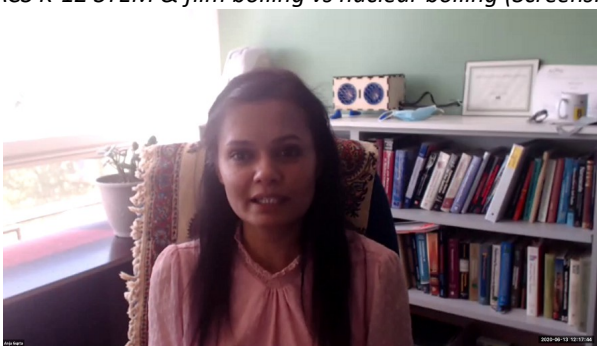
E-Town Hall Meeting with Dr. Claire Leon, Dr. Anju Gupta, and Kevin McNulty (13 June, 2020) *(Photos Only)*

*(*https://aiaa-lalv.org/e-town-hall-meeting-with-dr-claire-leon-dr-anju-gupta-and-mr-kevin-mcnulty/*)*

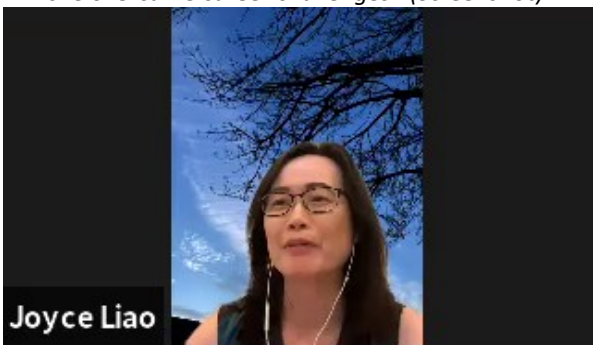
Our distinguished guest today, Dr. Claire Leon, explaining the the key issues in her career and answering STEM questions. (Screenshot)

Dr. Brian Brady's giving the short Welcome Message & commenting on ACS K-12 STEM & film boiling vs nuclear boiling (Screenshot)

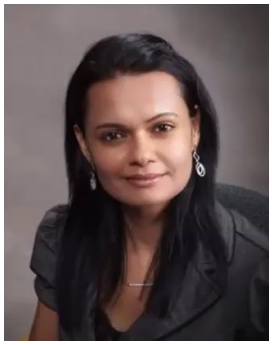
Dr. Claire Leon (Loyola Marymount University, LMU) explaining how she overcame career challenges. (Screenshot)



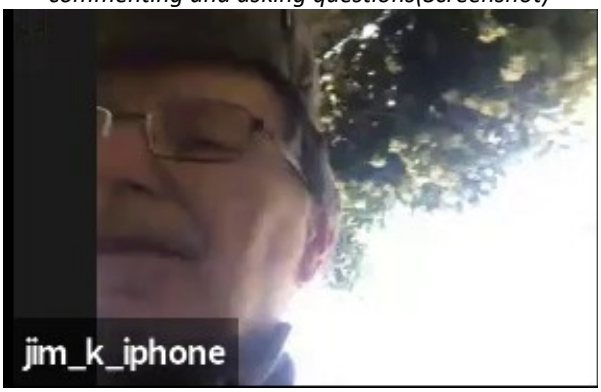
Dr. Anju Gupta talking about her career, STEM Education, and research projects from her office. (Screenshot)



Prof. Joyce Liao (Stanford U., Microgravity Space Medicine) commenting and asking questions(Screenshot)



Dr. Anju Gupta, Assistant Professor, Dept. of Mechanical, Industrial, and Manufacturing, Univ. of Toledo. (Courtesy of Dr. Anju Gupta)



Jim Kowalski (AIAA LA-LV Career & Workfroce Development Chair) making comments and asking questions. (Screenshot)

Mr. Kevin McNulty coaching about how to build strong resilience, cultivating it, hunting the good stuff, and bridging the gap between two worlds to cope with changes and transitions. (Screenshot)

The Event Horizon Telescope (EHT): Studying Black Holes from the South Pole with Dr. Junhan Kim (CalTech) (9 November, 2019) *(Photos Only)(Photo Courtesy of Ken Lui)*

Dr. Junhan Kim explaining the EHT Black Hole image, first-ever detected by mankind.

Dr. Kim explaining the science and engineering behind EHT.

Some attendees visited the AIAA LV-LV and talked to Ms. Niyati Chokshi, co-Chair of Events/Program, who is now in the master program in aeronautical engineering of USC.

More photos:

https://engage.aiaa.org/losangeles-lasvegas/viewdocument/november-9-2019-the-event-horizo

https://engage.aiaa.org/losangeles-lasvegas/viewdocument/november-9-2019-the-event-horizon

https://engage.aiaa.org/losangeles-lasvegas/viewdocument/november-9-2019-the-event-horizon-1

This ground-breaking discovery was awarded in a Science & Engineering Academy Award/Oscar-like ceremony, funded by Mark Zuckerberg, Chairman & CEO of Facebook.

Dr. Kim addressing the questions from attendees, and his expedition efforts in the South Pole with EHT.

Wonderful volunteers: Mr. Vlad Ionescu (Left) and Ms. Mallorie Vanghel (Right).

Wonderful AIAA LA-LV Council Members and Volunteers: (Left) Ms. Mohana Venkat (Events/Program Co-Chair), (Middle Left) Dr. Dennis Wonica (Enterprise Chair), (Middle Right) Ms. Pamela de Liz (President of Ziled Group, Volunteer), Mr. Robert Baker (Right-left, Volunteer, and now AIAA LA-LV Council Member) and Ms. Diana Didomenico (Right-right, Volunteer).

AIAA LA LV Award Ceremony for USC RPL LPL Student Rocket Team (1 October, 2019)

(Photos Only)(Photo Courtesy of Ken Lui)

(Left) Prof. Yannis C. Yortsos, Dean of the USC Viterbi School of Engineering; (Right) Dr. Dan Dumbacher, AIAA Executive Director.

Attendees checking in at the LA-LV Section table: (Left) Ms. Mallorie Vanghel (Volunteer) checking in attendees; (Right) Ms. Randi Arteaga, Chair, AIAA USC Student Branch.

(Left) Robert Friend, Boeing, AIAA LA-LV Section Chair 2017-2019; (Right) Dr. Chandrshekhar Sonwane, Aerojet-Rocketdyne, AIAA LA-LV Section Chair 2019-2021.

USC RPL LPL Rocket Team students receiving medals from Dr. Dan Dumbacher (Right), and Dr. Chandrashekhar Sonwane (Left).

(Left) Prof. Dan Erwin and (Right) Prof. Mike Gruntman, USC Professors of Astronautics and Aerospace and Mechanical Engineering.

Trophy with the Award Title and the names of the students, and the medals for the students.

More photos:

https://engage.aiaa.org/losangeles-lasvegas/viewdocument/october-1-2019-aiaa-la-lv-award-c

https://engage.aiaa.org/losangeles-lasvegas/viewdocument/october-1-2019-aiaa-la-lv-award-c-1

https://engage.aiaa.org/losangeles-lasvegas/viewdocument/october-1-2019-aiaa-la-lv-award-c-2

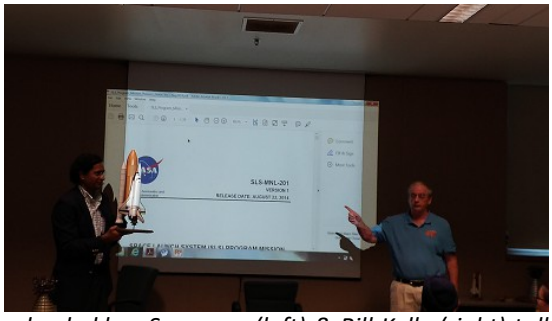
(Continued on Page 19)

Aerojet-Rocketdyne Outreach to UC Riverside (24 June, 2019) *(Photos Only)*

https://engage.aiaa.org/losangeles-lasvegas/viewdocument/june-24-2019-outreach-with-aeroject

Dr. Chandrashekhar Sonwane (Aerojet-Rocketdyne) talking about the exciting things his company has been doing. (Photo: Ken Lui)

Attendees listening carefully to the presentations. The two ladies on the right were the mother and wife of Dr. Sonwane.(Photo: Ken Lui)



Dr. Chandrashekhar Sonwane (left) & Bill Kelly (right) talking about rocket engines designed by Aerojet-Rocketdyne. (Photo: Ken Lui)

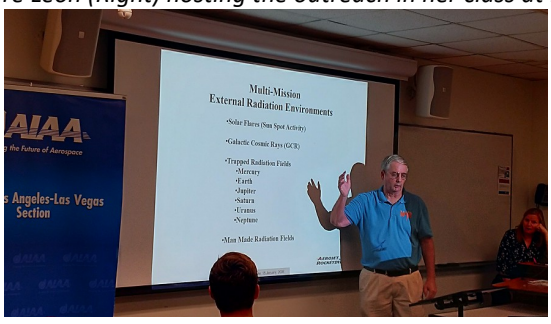
Students gathering around the speakers asking questions and seeking advice after the talks. (Photo Courtesy of Ken Lui)

Outreach to Loyola Marymount University (16 Oct, 2019) *(Photos Only)*(Photo: Ken Lui)

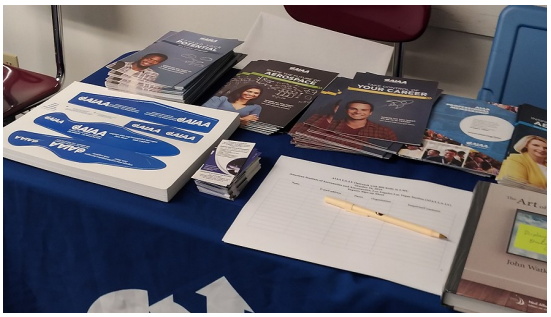
https://engage.aiaa.org/losangeles-lasvegas/viewdocument/october-16-2019-outreach-with-mr

Mr. Bill Kelly (Left, Aerojet-Rocketdybe-Retired, former AIAA LA-LV Section Treasurer) listening to the questions from the audience. Prof. Claire Leon (Right) hosting the outreach in her class at LMU.

Student completely absorbed in the exciting and humorous talk by Mr. Bill Kelly.

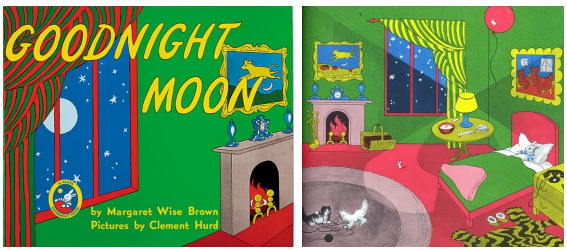


Mr. Bill Kelly talking about the Multi-Mission External Radiation Environments.



AIAA LA-LV Section Exhibition during the outreach

Cultural Significance of Our Moon *(Continued from Page 1)*



One of the bedtime books that parents and caregivers read to children at bedtime is Goodnight Moon. (Courtesy: M. Thangavelu)

Children develop an emotional coupling with our Moon. The bedroom in our old home had a view window looking east. Some days, we could see the moonrise from our bed. One night, after our bedtime read, little Paul saw the waning half Moon and wondered aloud if she needed a change of battery.

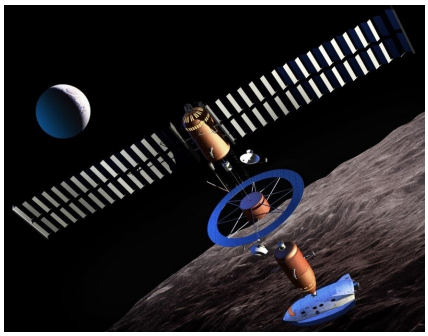
Though our Sun is the giver of energy and life and dictates much daily life around the globe (Ra in Egyptian or Ra-vi in Sanskrit) our Moon is the object that is imprinted in our psyche very early in our lives. Hence the fascination with our Moon begins early and continues to impact our lives in ways both understood and still to be.

The Moon appears on many national flags and the crescent Moon is a widely recognized symbol.

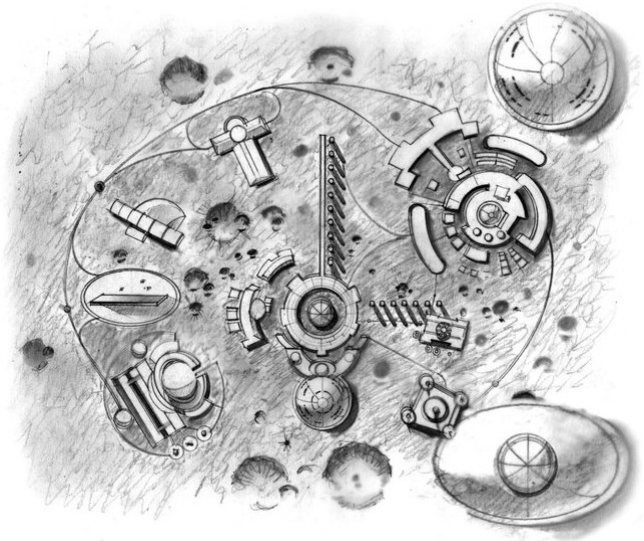
Solar and lunar eclipses are transitory events that are purely based on orbital alignments of the Sun, the Moon and planet Earth. Almanacs from early civilizations show that these events were predictable even long ago. Yet, as they occur, such events evoke awe and wonder in people all over the world even today. Large groups flock to locations around the world to witness eclipses. While some classic scientific observations have been made during such events, rituals and cultural events are also planned around such occultations.

While modern scientific dogma is reticent and practitioners stay away from the illogical and alogical, astrologers hold the Moon in high esteem, and lunar motion impacts horoscope in very significant ways.

Though our Moon is the focus of scientific curiosity, many culturally relevant concepts have been proposed to bury time capsules, set up updateable humanity archives, DNA repositories and even presidential libraries and spiritual sanctuaries on our Moon. Ideas to hold lunar Olympics and a United Nations Summit headquarters have also been thought about. Orbiting luxury hotels, retirement resorts, cremation services for loved ones and memorial parks and monuments too have been proposed. Races on the Moon have been proposed by students in our studio and there is a prize offered for the first circumnavigation across the lunar terrain. Lucky, no deep oceans to cross but be wary of those wicked and lethal solar storms that can sweep through at short notice !
Earth-looking, high-resolution cameras placed on lunar landers, live streaming images of the Earth disc is an idea that is gaining attention not only for Earth Observation but also to instill a new global awareness of the fragility of our home planet and our biosphere that seems to be under siege by forces including the incessant ravages on nature by our own species.



Lunar orbiting hotels would make for ideal one week vacations for those who are bored of Hawaii, skiing the Alps, diving in the Maldives, or staring at lions in African safaris. (Courtesy of Madhu Thangavelu)



The author's proposal for a lunar humanity center would house the United Nations Summit Hq. as well as a variety of facilities including retirement homes and even host sporting and entertainment events like the Lunar Olympics. (Courtesy of Madhu Thangavelu)

(Continued on Page 20)

A Useful Model, Readiness Factors, and Some Definitions *(Continued from Page 2)*

If not, does the definition need another look?" For example, if the crew cannot be certain of emergency air supplies, does this impact system availability? If not, is our definition at fault or our thinking? These exercises, occurring smack dab in the middle of monthly risk management meetings attending by dozens of sustainers help to reinforce the importance of the warfighter's mission and help create a common language and way of approaching sustainment. It creates a culture of warfighter support.

With the few words we have left, let's dive into a lexicon for sustainment. This lexicon is associated with the Complex System Sustainment Management Model mentioned above and available at charlesvono.com.

As mentioned before, the model is depicted in the graphic accompanying this article. To repeat, *sustainers observe the well-defined system to help create a priority list of risks to be mitigated in time to avoid loss of mission capability.* Sustainers support the warfighter's mission (sustainer mission statements that say something like "Our mission is to sustain" are much less effective). However, every USAF weapon system is subject to non-warfighter requirements that can change during the sustainment phase, such as environmental directives. The key enablers to this approach are people, data bases, and processes. These enablers must be supported by management. For instance, people are encouraged to identify emerging failure modes by how they are treated at risk management meetings. Data base and data tools are prioritized for regular upgrades.

This model is simple to remember, but has a tremendous power to provide clarity to every nook and cranny of sustainment management. More on that later in this article.

The following CSSMM definitions are provided in a specific order. The first ones are basic definitions and the later ones get into more subtle areas.

Readiness Factors: Two to six system independent characteristics that, if violated, will affect the system's ability to perform its mission. For instance, the vast majority of systems must be both reliable when used and available when needed. Some must provide accuracy while others need to deliver persistence over a target. Some systems might require survivability on orbit. Others may need stealth. Readiness factor requirements are often measured across many individual systems and aggregated. This improves the precision of the estimate, usually to the benefit of the mission.

Sustainment: Support of the system to ensure continued mission capability. Some view logistics as sustainment, or supply as sustainment, or depot activities as sustainment. Others raise expert engineers or astute program managers to be the most important element of sustainment. In this lexicon, sustainment encompasses all the skills required to provide support of the deployed system. Experts in funding sources are just as important as expert repair techs or engineers.

Mission: The reason the system is employed. The military warfighter's or civil system operator's mission is the sustainer's mission. To emphasize: Sustainer mission statements that use the word "sustain" remove themselves too far from their actual mission. Sustainers must see themselves as part of the weapon system warfighter's or civilian system operator's team.

System: System: A set of interacting components. In this management model, the system includes everything required for the operator to employ the hardware and embedded software to achieve the mission. For instance, manned strategic bombers are designed and deployed to carry out the military doctrine of strategic bombardment against a nation's ability to wage war. World-wide lighter than air Wi-Fi vehicles are designed and deployed to ensure internet coverage in even the most remote parts of Earth. An SR-71 cannot fulfill its recon mission without its associated tanker aircraft.

Sustainment Risk: A risk that can be shown to impact the mission via the system readiness factors. When programs are spawned to mitigate an identified sustainment risk, they should have their own *program* risk boards. Contractual problems such as between contractors or between contractors and the government can be dealt with via *business* risk management boards. Mixing these boards creates confusion and reduces effectiveness.

(Continued on Page 21)

Parker Solar Probe Odyssey *(Continued from Page 3)*

The fundamental plane for each plot is the ecliptic, and an orthogonal projection line from each time tick to the ecliptic is drawn to impart a 3-dimensional impression. This effect is enhanced by viewing the plot from a perspective at 45° ecliptic north latitude[1] and 270° ecliptic longitude. Direction toward zero ecliptic latitude and longitude is denoted in black by the rightward-pointing arrow in each plot annotated "To ♈". Note that projection lines will be too short to see when sufficiently near each plot's nodes on the ecliptic, and Earth's orbit is virtually coincident with the ecliptic, so **green** dotted lines are absent.

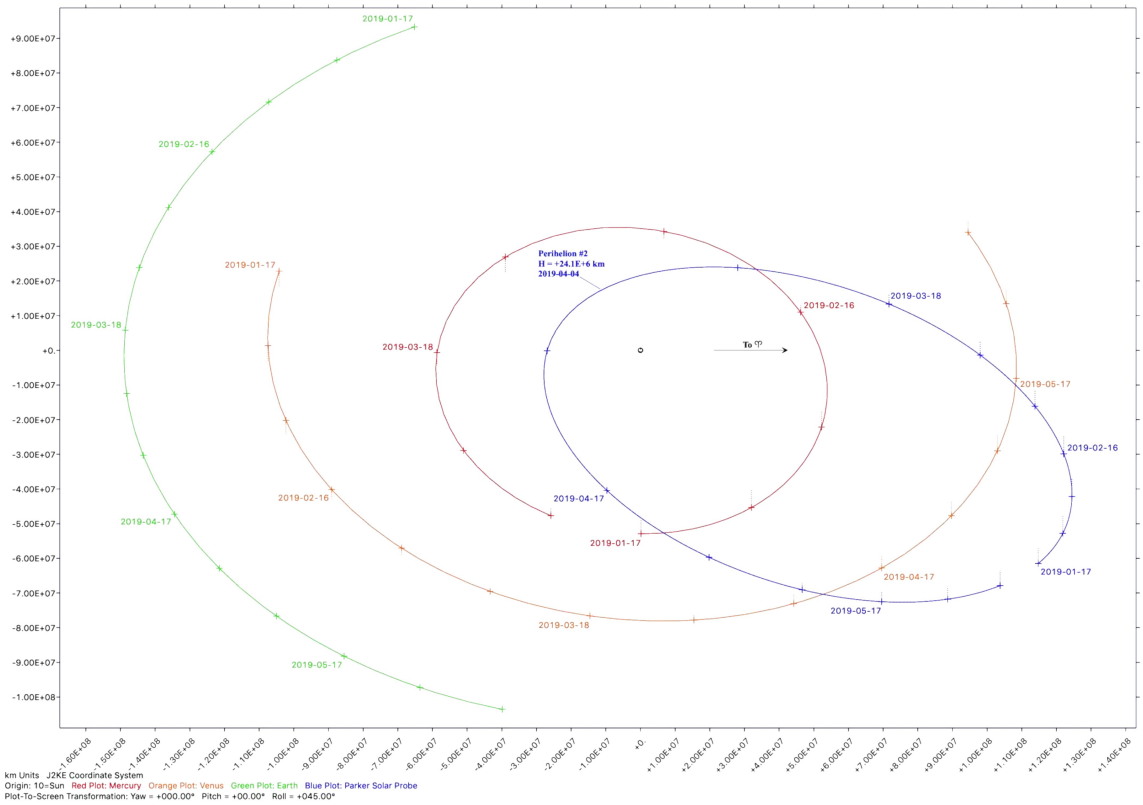
Near the resolution limit of each plot, the Sun's photosphere (1.4 million km in diameter) is discernable at the origin. Zooming in on the Sun sufficiently will reveal its rotational equator and its parallel of latitude at 80° north.

1 "Ecliptic north" very nearly coincides with the direction of Earth's heliocentric angular momentum vector.

About the Author:
Mr. Adamo is an astrodynamics consultant focused on space mission trajectory design, operations, and architecture. He works with clients primarily at NASA and in academia.

Until retirement in 2008, Mr. Adamo was employed by United Space Alliance as a trajectory expert, serving as a "front room" flight controller for 60 Space Shuttle missions. Along with console duties during simulations and missions, this job entailed development of trajectory designs, software tools, flight rules, console procedures, and operations concepts. Mr. Adamo began his career at the Perkin-Elmer Corporation where he developed and operated proof-of-concept software for computer-controlled polishing of optical elements. He has degrees in Physical Sciences and Optical Engineering from the University of Houston and the University of Rochester, respectively.

Mr. Adamo is an AIAA Associate Fellow and the author of many publications (ref. www.aiaahouston.org/adamo_astrodynamics/). He has received numerous awards, including 14 NASA Group Achievement Awards. *(Continued on Page 22)*



Trajectories (2019-01-17 to 2019-06-06) of the Parker Solar Probe (PSP, Blue Color), Mercury (Red Color), Venus (Orange Color) and Earth (Green Color) (Courtesy of Daniel R. Adamo) (Please enlarge to see more details.)

(Continued on Page 22)

Introduction to Space Architecture *(Continued from Page 5)*

this vision can be made practical. Creating space architecture that way would be inefficient because each architect's vision would require the design of a new spacecraft. Analogous to aircraft design, architects design the interior of an aircraft, and none of them are designers of the plane itself. For them to implement the vision and then to create the aircraft is not practical. For highly constrained regimes such as aircraft and spacecraft, doing the engineering first and then implementing the architecture vision makes sense.

Space Architects Are Space Architects: Mission of An Architect in Space Exploration

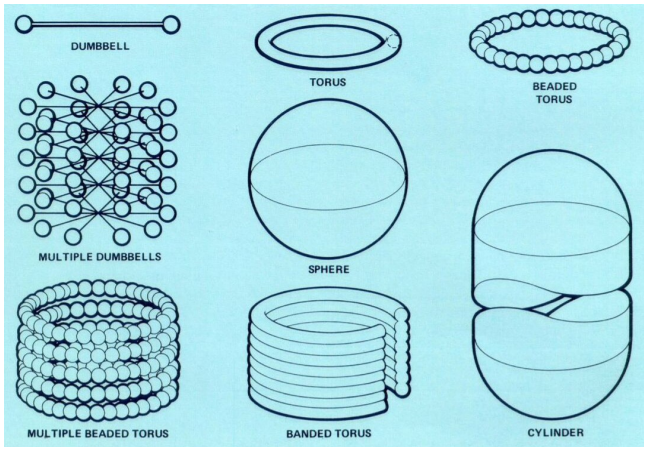
Traditionally, a space architect was a systems engineer, because systems engineers were the only ones on a design team who had enough knowledge about a spacecraft that they could design an interior. Now, people can be trained to be actual space architects, whose duties are to create interiors within constraints. System engineers no longer have to do this job; instead they can advise space architects on constraints.

In space architecture, it is not practical to design first and then to see what can be implemented through engineering. It is because the diversity of structures that are valuable for space travel and cost are minimal—that is why everything should be domes, spheres, toruses, cylinders, and pillow shapes.

Space architects used to be and are referred to systems engineers, but they shouldn't be any longer. With the increasing demand for designing valuable interiors for spacecraft and space habitats, it makes more sense to have real space architects rather than having systems engineers do space architecture.

Why Should Systems Engineers Decide The Spacecraft Structure?

The reason system engineers should design the structures is that the costs involved for introducing additional mass and volume are huge. Thus, deviating from a mathematically ideal structure dramatically decreases the amount of funding available for the interior design. Doing so is very rarely, if at all, worthwhile. In other words, the added value that a structure has when an architect designs it is not great enough to offset the dramatic increased cost of introducing additional mass, additional volume, and nonideal sizes and forms into rockets.



Ideal shapes for space colonies. NASA SP-413 — SPACE SETTLEMENTS — A Design Study, p. 40 (Courtesy of Anastasia Prosina)

Deviating from things that are not efficiently packed into cylinders dramatically decreases the amount of volume architects have to work with.

Rather than trying to guess what structure is valuable, engineers should continue to provide the constraints, such as the rockets available, their payload masses, fairing sizes, and what spacecraft restrictions are in terms of the spacecraft's available volumes, forms, inputs, and outputs.

In the far far future, this fact could change when the cost of space travel comes down dramatically, possibly as people live in larger numbers on other worlds, rather than only in orbit. For the foreseeable future such as this century, however, space architecture should focus on designing within the engineering constraints and begin after the engineers' work is done.

CubeSats have a well-defined size, and everybody in the world can fill this CubeSat with whatever they want, as long as it meets the constraints of the CubeSat. Anybody can go out and design the interior of the CubeSat, and people do this type of designing already, greatly expanding the diversity of things that are implemented in CubeSats. The same scenario could exist for spacecraft interiors. Engineers can design the rockets, rocket cabins, space stations, and habitats, and then space architects can fill that structure. *(Continued on Page 23)*

AIAA LA LV Award Ceremony for USC RPL LPL Student Rocket Team (1 October, 2019) *(Continued from Page 13)*

Students from the RPL LPL Rocket Team telling the stories of their successes, frustrations, and expressing their appreciation.

USC RPL LPL Team staff members recognized during the award ceremony.

Prof. Dan Erwin introducing the USC RPL LPL Student Rocket Team.

A USC RPL LPL Team student representative showing their activities.

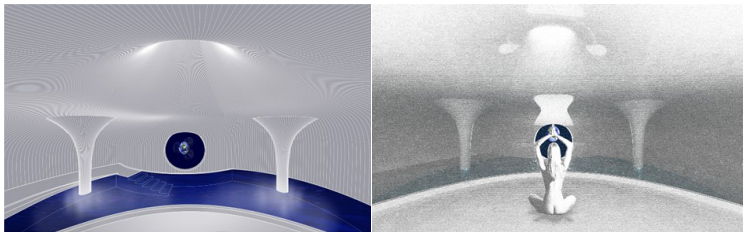
Attendees paying attention to the award ceremony. Front Left: Dr. Dan Dumbacher, AIAA Executive Director; Second to Left, Mr. Mike Todaro, Director of Millennium Space Systems, former AIAA LA-LV Section Chair (2016-2017).

Several AIAA LA-LV Council Members were recognized during the ceremony. Upper left, from the left: Dean Davis, Bill Kelly, and Dr. Dennis Wonica; Upper Right, Dr. Lisa Kaspin-Powell; Lower left: Marty Waldman; Lower right: Dr. Chandrashekhar Sonwane.

Mr. Bill Kelly (Left, Aerojet-Rocketdyne-Retired, former AIAA LA-LV Section Treasurer) and Ms. Mallorie Vanghel (Right, Volunteer) helping people checking in and getting their badges.

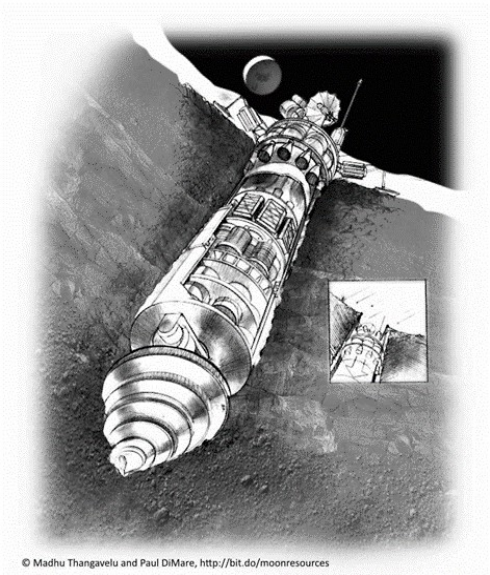
Cultural Significance of Our Moon *(Continued from Page 15)*

The European Space Agency commissioned an artist, Spanish artist Jorge Mañes Rubio who proposed a lunar temple be located in the south polar region of the Moon. [credit ESA]

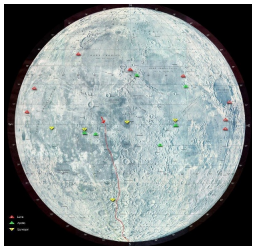


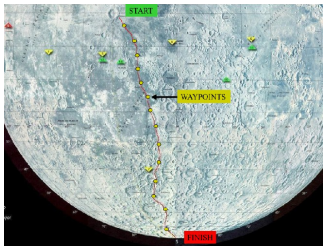
In the Space Architecture Seminar in the USC School of Architecture a student proposed a Lunar Bath & Spiritual Nexus using polar water-ice resources. [credit Pornpavee Mungrueagsakul]

A graduate student in the Astronautical Engineering studio in the Viterbi School of Engineering created the MOBIUS lunar tourism concept for lunar tourism. [credit M.Lali]

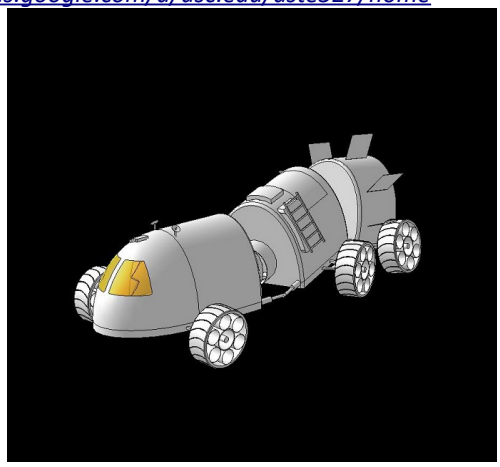


The author proposed a millennial time capsule and presidential library on the Moon.

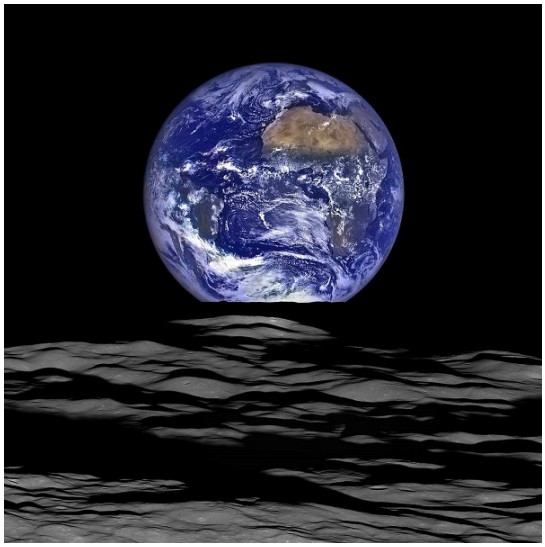




The 2004 USC Hercules Race on the Moon would have the entrants start in the equatorial region and end at the south pole where they will be picked up from polar orbiting craft(Gateway?) for Earth return. The HERCULES Project slides may be accessed at: https://sites.google.com/a/usc.edu/aste527/home



The Selenopede racer proposed for the USC 2004 HERCULES Race on the Moon. Schematics and systems for this rover may be accessed at https://sites.google.com/a/usc.edu/aste527/home



NASA's Lunar Reconnaissance Orbiter (LRO) recently captured a unique view of Earth from the spacecraft's vantage point in orbit around the moon. In this composite image we see Earth appear to rise over the lunar horizon from the viewpoint of the spacecraft, with the center of the Earth just off the coast of Liberia (at 4.04 degrees North, 12.44 degrees West).[credit NASA 2015]

(Continued on Page 24)

A Useful Model, Readiness Factors, and Some Definitions *(Continued from Page 16)*

Assessment: Observation of the system to find changes in performance, determine if those changes affect the system readiness parameters, and characterize them if they do.

Complex System: Systems are considered complex when they can enter states unpredictably. (In ICBMs this property leads directly to the concept of failing safe.)

Complicated System: A system with many, many components interacting in many, many ways.

Lead Time Ahead: A phrase meant to capture the need to consider when the risk might be realized versus the time it will take to mitigate it. Design and development schedules are fixed by many other factors. In the sustainment phase, projects to mitigate future risks are primarily created based on the timing of risk realization.

Capabilities Baseline: Once the system is deployed, the operator begins to perceive and depend upon capabilities of the system that might not be captured in any design documentation. This becomes an important baseline for the sustainer *which might not be documented anywhere*! This is yet another reason sustainers must be in the same team as the operators. (In addition, this concept also gets us musing about the other factors that are different when you are in the sustainment phase such as schedule, system modifications integration, deployment scheduling and integration, & etc.)

Process Discipline: The actions of your people as they follow organizational processes. Improvements can only occur if the teams respect the processes and improve them instead of ignoring them. Audits that focus on improvements instead of blame and processes to quickly change processes support this organizational goal. Lack of discipline will result in confusion, such as data acquired over decades that cannot be used together in the same graph to characterize the system. Process champions are farmers; crisis saviors are cowboys. Sometimes cowboy heroes are needed, but when they ride off into the sunset the bad guys return unless the farmers made process changes and follow them.

That's enough for now. For a longer list, see my blog: "Complex Systems Sustainment Model Glossary" at charlesvono.com.

So, switching gears, another set of definitions are associated with the concept of a management model. A management model helps the team stay focused on the important actions required today, this week, this month, this year, amidst a sea of crisis activity typical to a sustainment office. A good management model is:

a. Self-improving – anti-fragile, or at least robust
b. Constant -- unaffected by changing laws, regulations, or fads
c. Applicable to the very complex systems employed today
d. Memorable -- easily called to mind
e. Practical -- easy to apply, common lexicon
f. Integrated -- internally consistent

This CSSMM model can be used to drill down into specific requirements for your team. For instance, since you know that the products of your risk management system must allow your finance folks to effectively communicate with your purse-string holders, processes can be tailored to make that most effective. Because your risk managers must be able to understand the observations of the system and the observers' assessments, key steps would include testing consistent over decades so that resulting data can be used together.

If your sustainment team understands this model, team members and managers, it keeps them focused on the mission and it helps them understand what are the important things to do this day, this week, this month, or this year. It helps make each member a leader. It creates a culture.

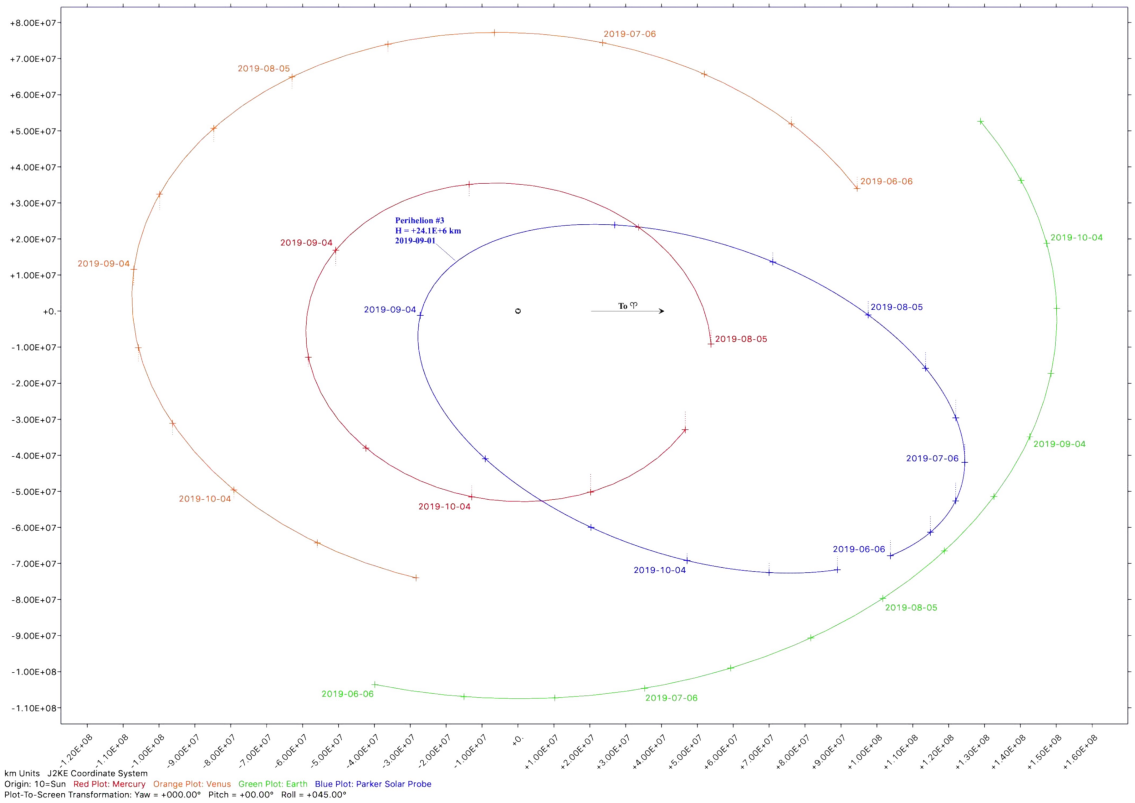
Next article: the sustainment risk system. How is it different from all other risk management systems?

About the Author:

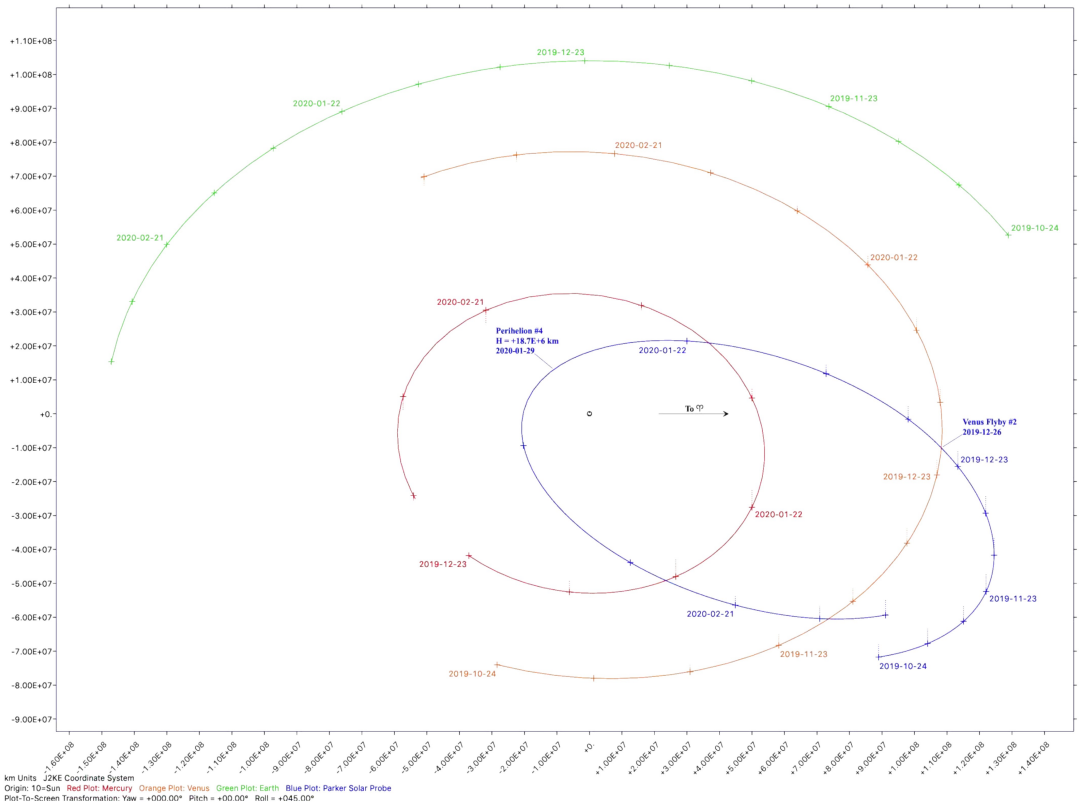
Please refer to the AIAA LA-LV May Newsletter (p. 31) in the AIAA Member Spotlight for the author' biography.

aiaa-lalv.org/download

Parker Solar Probe Odyssey *(Continued from Page 17)*



Trajectories (2019-06-06 to 2019-10-24) of the Parker Solar Probe (PSP, Blue Color), Mercury (Red Color), Venus (Orange Color) and Earth (Green Color) (Courtesy of Daniel R. Adamo) (Please enlarge to see more details.)



Trajectories (2019-10-24 to 2020-03-12) of the Parker Solar Probe (PSP, Blue Color), Mercury (Red Color), Venus (Orange Color) and Earth (Green Color) (Courtesy of Daniel R. Adamo) (Please enlarge to see more details.) *(Continued on Page 25)*

Introduction to Space Architecture *(Continued from Page 18)*

Why Do Systems Engineers Get to Decide The Shape of a Space Habitat?

The most significant determinant of the shape that is best suited for habitat from an engineering perspective is whatever best accommodates the internal pressure of the living volume and fits adequately into rockets. The cost is smaller to proceed with a minimum amount of mass and volume of the habitat structure, thus reserve more funding to maximize the amount of mass, volume, complexity, and function of all the furniture and interior structures that are inside of a habitat.

If you deviate from the ideal structures for space travel, the cost of doing so is so high that it dramatically decreases the funding available for the interiors. By supporting the perfect exterior arrangement for space travel, you significantly reduce the baseline structural cost and dramatically increase the funding available for internal design.

Thriving, not surviving.

During the long-duration missions, astronauts/space tourists will struggle with seeing the same people, performing routine tasks, isolation, and the small volume of a space habitat. It will cause rising conflicts as well as affect the overall wellbeing of each person. Not everyone can tolerate the isolation and loneliness encountered on long space flights, but a well-thought-out human-centered design can significantly relieve these issues, thus helping humanity to explore space without causing harm.

About the Author:

Anastasia Prosina is an award-winning aspirational futurist and practitioner in Space Architecture, the nascent field of helping people thrive in small spaces in outer space. She is the Founder & CEO at Stellar Amenities, a company with the mission of complementing space habitats with lightweight, deployable & reconfigurable elements to support wellbeing in space.

Anastasia has been involved in numerous space projects, from designing lightweight interior habitation structures for the TESSERAE self-assembling space station at MIT Media Lab's Space Exploration Initiative to working on an Iceland-based Martian Analog Habitat commissioned by Mars Society. Her other places of work include aerospace company Excalibur Almaz, 4th Planet Logistics, and Galaktika Space.

Anastasia has spoken publicly around the US about space architecture, and wrote three papers on the subject matter, including co-authorship with the former Deputy Administrator of NASA, Dava Newman.

Anastasia holds a Masters in Space Architecture from Sasakawa International Center for Space Architecture in proximity and collaboration of NASA Johnson Space Center in Houston. Anastasia received a Bachelor's in Urban Design from Novosibirsk State University of Architecture, Design, and Art.

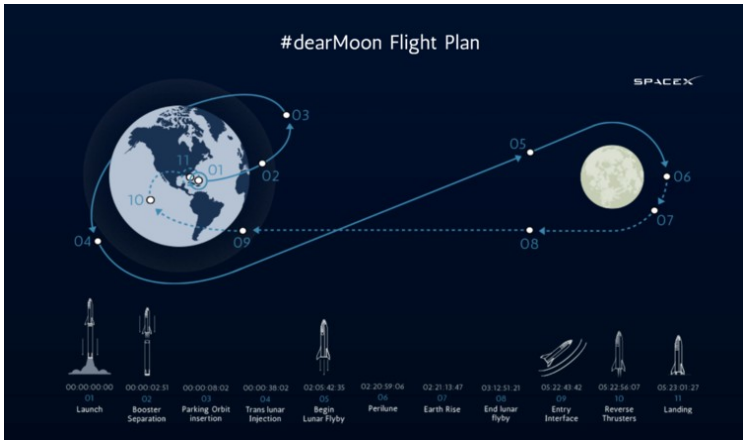
Anastasia will join the fellow space architects for the AIAA LA-LV Space Architecture Gathering 2020 on August 22, 2020. (conta.cc/3f9jJYT). See page 41.

Cultural Significance of Our Moon *(Continued from Page 20)*

The Moon Village Association is an international citizen organization that proposes to plant such an Earth-looking telescope as part of their first mission to the surface of the Moon, aiming to bring humanity together in a peaceful, truly progressive and globally inclusive endeavor. Seasoned policymakers, scientists and engineers within the Moon Village Association and citizen organizations like the National Space Society and the Planetary Society provide valuable feedback to guide the activities and projects of NASA and other space agencies around the world.

In recent years, commercial space activity has shown promise to become a self-sustainable human space activity, using space tourism as the springboard for a variety of activities. Starting with suborbital experience and private citizen tours of Earth-orbiting space stations, the foundations are being laid for lunar tourism. The MOBIUS mission proposed by a student at USC looked at such a mission.

The Dear Moon project is an example of what a lunar orbiting tour may be like. An artist from Japan wants to take his friends on a seven-day lunar orbital swing-by mission so they can all be inspired to literally create out-of-this-world art during the trip, and in the process attract children to take up such adventures when they grow up. Such a commercially self-sustaining project is proposed by SpaceX, a pioneering space company that is located a few miles down the road from Palos Verdes in the city of Hawthorne. SpaceX is already building prototypes of the Starship, the largest rocket ever, to fly this group of artists around the Moon and back.



SpaceX has been hired by Japanese billionaire garment designer to fly him and his artist friends on a one-week lunar swingby mission that will offer the group ample time to create inspired lunar art works.[credit SpaceX]

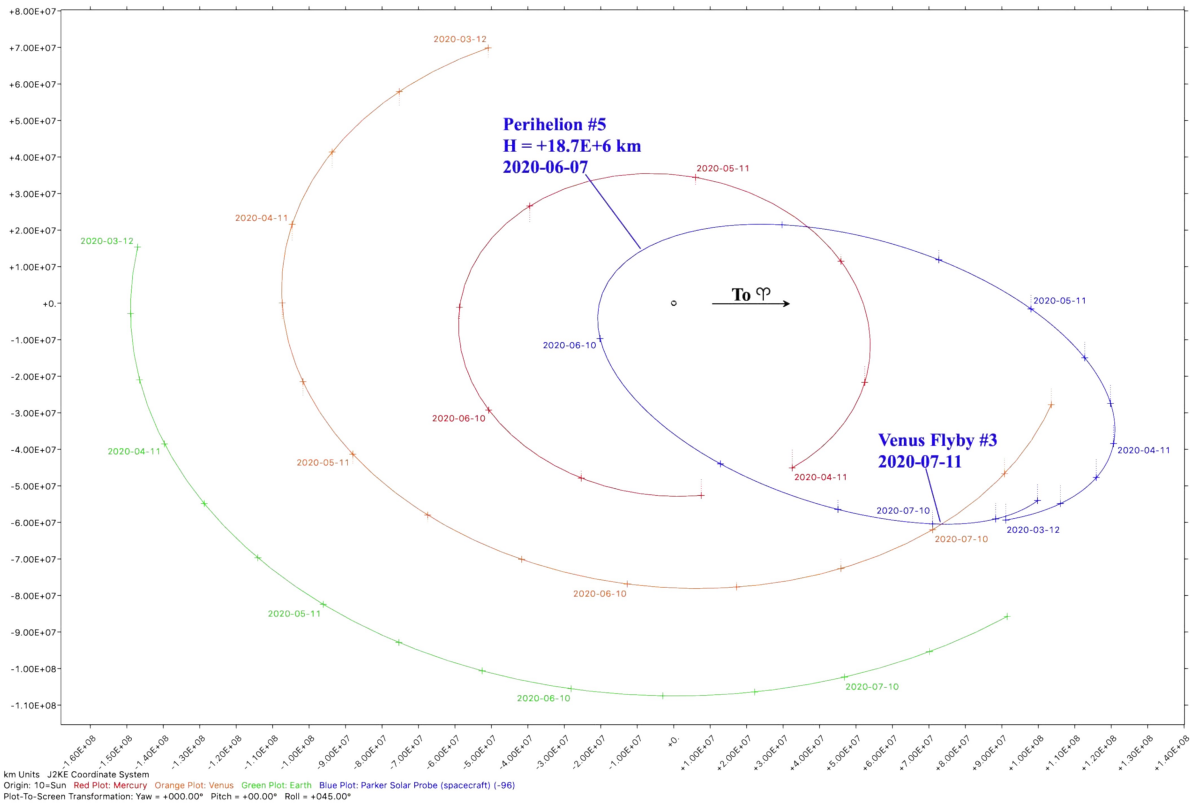
An early prototype of SpaceX Starship, the largest rocket ever, being readied for tests at the Boca Chica site in Texas.[credit SpaceX]

Museum of the Moon is an ongoing traveling exhibition co-commissioned by a number of creative organizations brought together by some European artists led by visionary artist extraordinaire, Luke Jerram. The artwork has also been supported in partnership with the UK Space Agency, University of Bristol and The Association for Science and Discovery Centres.

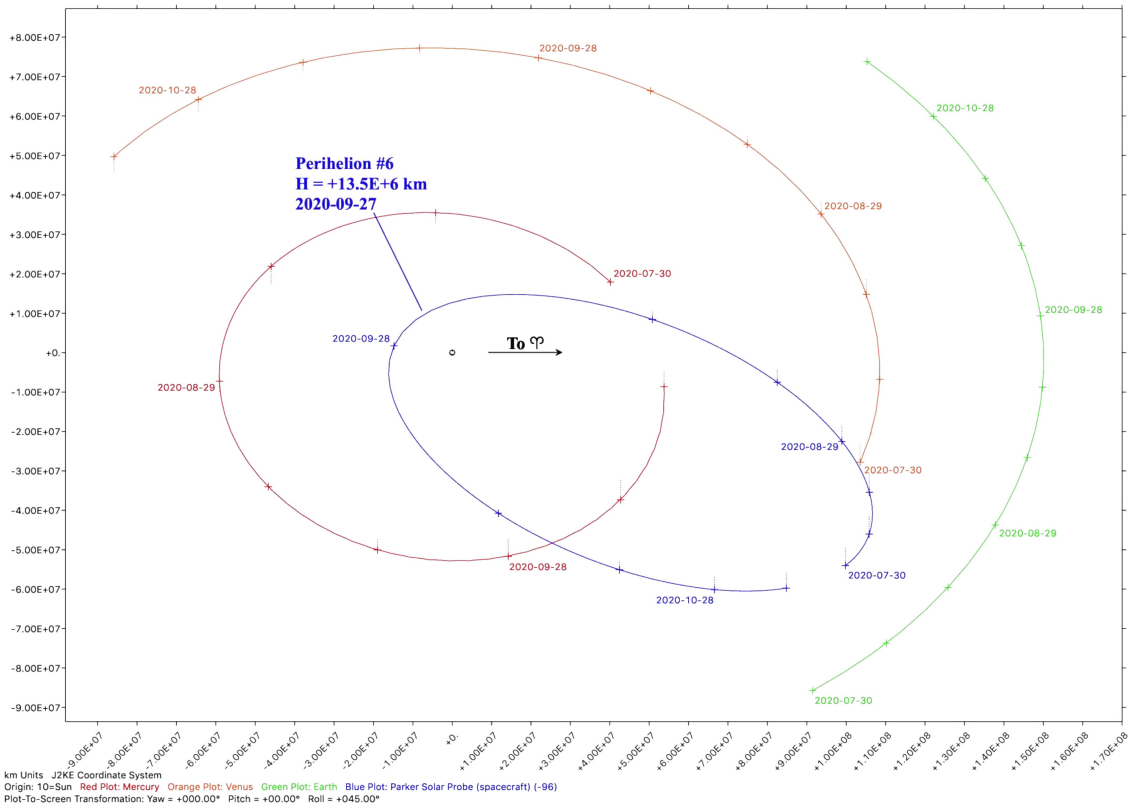
Museum of the Moon created by Luke Jerram is a 23-foot glowing globe of the Moon, created with high resolution NASA images printed on the surface, that is a travelling exhibition going around the world, amazing and inspiring people of all ages.

(Continued on Page 26)

Parker Solar Probe Odyssey *(Continued from Page 22)*



Trajectories (2020-03-12 to 2020-07-30) of the Parker Solar Probe (PSP, Blue Color), Mercury (Red Color), Venus (Orange Color) and Earth (Green Color) (Courtesy of Daniel R. Adamo) (Please enlarge to see more details.)



Trajectories (2020-07-30 to 2020-11-07) of the Parker Solar Probe (PSP, Blue Color), Mercury (Red Color), Venus (Orange Color) and Earth (Green Color) (Courtesy of Daniel R. Adamo) (Please enlarge to see more details.) *(Continued on Page 27)*

Cultural Significance of Our Moon *(Continued from Page 24)*

Great religions of the world, Islam in particular, hold the Moon in high esteem. In the millennial Architecture+Engineering Space Architecture studio at USC, a student with local Imam consultation, proposed a concept for a mosque on the Moon. The student who proposed this concept is now a minister in the Saudi Arabian government. In the same studio, another student proposed large swaths of the Moon for conservation, much like our national parks, to be left undisturbed by any development, as pristine nature preserves. This may be a visionary goal, suggesting that humanity should not deface our Moon with economic activity ?

Astronauts returning from space seem to agree that their worldview has changed after experiencing the view of planet Earth from above. The Apollo crew in particular, after having seen the entire Earth disc synoptically from lunar distance, seem to have had a profound life-changing experience. Despite their scientific background and years of intensive crew training, they seem to gravitate toward the spiritual.

Buzz Aldrin, Apollo 11 pilot took communion upon landing on the Moon before he stepped out to explore. Astronaut Alan Bean took up painting lunar scenery after Apollo 12 mission. Astronaut Edgar Mitchell had a spiritual awakening after Apollo 14 mission and referred to the experience as Sankalpa Samadhi from the Sanskrit scriptures and co-founded the Institute of Noetic Sciences, an organization that studies paranormal phenomena. And this "Overview Effect" that philosopher Frank White studies is brought about by directly seeing the unique nature of Earth and observing the fragility of the biosphere first hand from deep space.

Space activity, human space activity in particular, seems to be pointing humanity toward a new level of refinement, from our preoccupation with the "technological sublime" that scholars Perry Miller and David Nye refer to in the our society, to reach for a higher, more wholesome spiritual sublime.

Our Moon features in many imaginative science fiction stories and movies. Since the Moon is so close to Earth and real, such stories and visions tend to vicariously transport the reader and the viewer as no other alien landscape might.

2001:A Space Odyssey is a notable movie that was first screened in 1968, a year before the Apollo 11 moon landing. The scenes from 2001: had a profound impact on the science and technology community, not to mention the general audience who were equally impressed by the cinematography, the sets and the story, all of which were thoughtfully put together by the team that included accomplished space technology advisers as well.

As our Moon orbits the Earth, it is the only object with a highly visible disc and landmarks that we can directly observe without permanently damaging our eyes. The planets, stars and even the occasionally visible Earth-orbiting International Space Station all pale in comparison.

This wondrous celestial object that is our Moon is a continent that is truly a global ambassador because it orbits our Earth, it is visible from all continents and latitudes, engages all our peoples awe and fascination without reservation, and through dynamic phases, attracts our attention each and every day.

Space is the ultimate arena for the expression of freedom for all humanity, as we know it. Human activities in space liberate us from the confines of Earth's cradle, refine our sensitivities, and elevate our aspirations beyond our myopic view of resources, national boundaries and cultures, governance philosophies and policies, diverse governance and civic models; Nature in her starkest, rawest mode, guiding, nudging, our species to become citizens of the solar system and beyond, sensitizing us to the immediate cosmic environment beyond our home planet.

We now know that our feelers into space we call "space situational awareness", knowing the behavior of our Sun, our Moon, the solar wind that arrives via the magnetic fields, the coronal mass ejections and the high energy particles that create mesmerizing auroras on Earth and the paths of the Earth-crossing asteroids and comets are all vital to our survival.

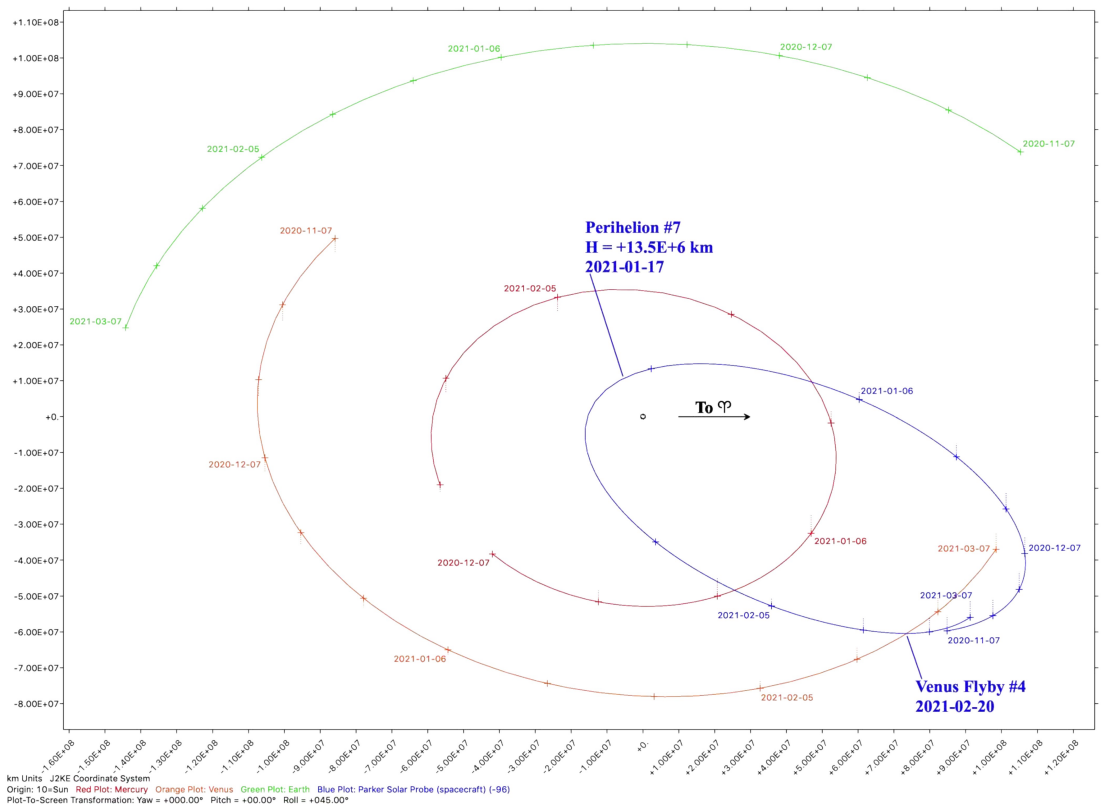
Floating silently in the deep black velvety void, our Moon is the closest extraterrestrial body where our species can come together and work together in plain sight of all humanity on Earth, to preserve and protect as we step out of cradle Earth to embrace the raw beauty and bounty of nature.

Our Moon is the closest natural site for humanity's aspiration to become a truly spacefaring species.

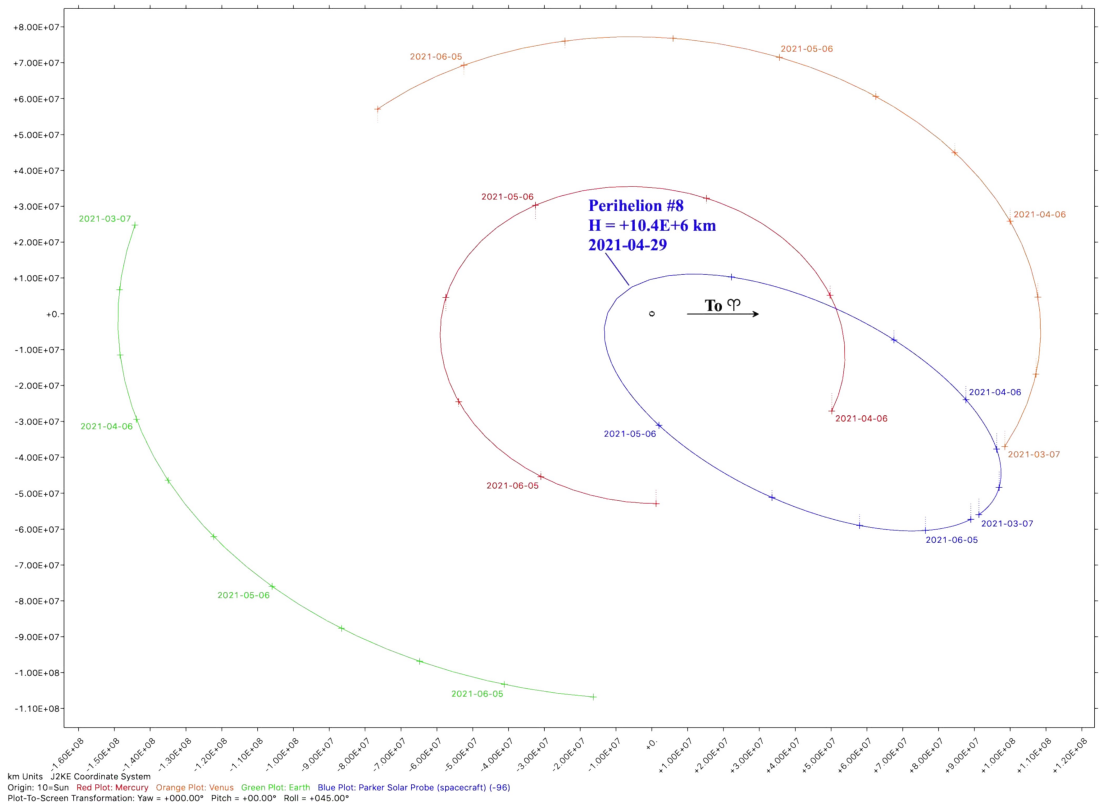
Half a century ago, our species set forth on an incredible adventure, and landed, walked and drove vehicles, sang and even played golf while conducting scientific exploration on our Moon. The first human footsteps on an extraterrestrial world were taken fifty years ago on July 20, 1969, when Neil Armstrong and Buzz Aldrin stepped on our Moon.

*This bootprint marks one of the first steps human beings took on the moon in July 1969, which was made by American astronaut Buzz Aldrin during the Apollo 11 mission, and is a cultural asset not only for Americans who made it happen, but for our entire species. We must do whatever it takes to preserve it from the elements and imminent missions to the Moon that can deteriorate, and perhaps, even erase it. (Credit NASA)****(Continued on Page 28)***

Parker Solar Probe Odyssey *(Continued from Page 25)*



Trajectories (2020-11-07 to 2021-03-07) of the Parker Solar Probe (PSP, Blue Color), Mercury (Red Color), Venus (Orange Color) and Earth (Green Color) (Courtesy of Daniel R. Adamo) (Please enlarge to see more details.)



Trajectories (2021-03-07 to 2021-06-15) of the Parker Solar Probe (PSP, Blue Color), Mercury (Red Color), Venus (Orange Color) and Earth (Green Color) (Courtesy of Daniel R. Adamo) (Please enlarge to see more details.)

Cultural Significance of Our Moon*(Continued from Page 26)*

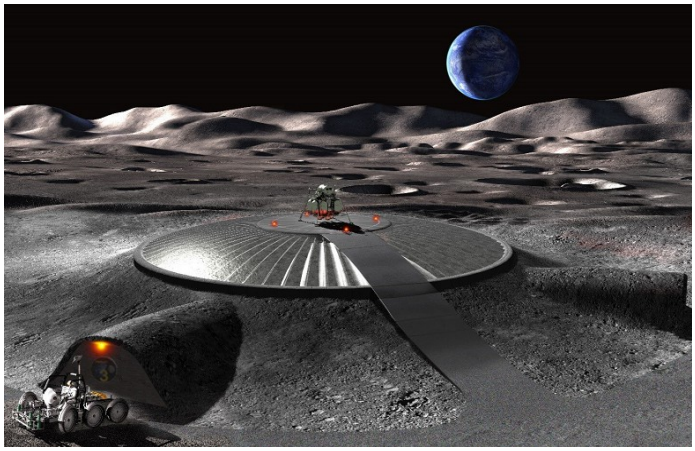
Great civilizations always preserve history and we should do the same to protect these first bootprints from the harsh lunar surface environment, including the constant micrometeoritic bombardment and thermal effects that, if left alone to nature, will erode them over time. In fact, the recently published NASA Artemis Accords suggests that we take care not to disturb those historical sites and artifacts that we left there.

NASA recently announced the Artemis mission to put a woman and a man on the Moon as soon as possible. This announcement was followed soon after by The Artemis Accords that proposes the implementation of an international agreement to preserve and protect such space and these extraterrestrial artifacts of cultural and historic value. As our journey to the Moon and beyond continues, we cannot allow the traces of the first steps of our species beyond cradle Earth to be lost.

Many nations have their eyes on ambitious missions to the Moon in the near future. It is important that the whole world carefully coordinate such an extraterrestrial effort.

Since our Moon is small, lacks an atmosphere, and poses very low gravity, rocks and debris thrown up by landing vehicles can achieve much more energies than bullets from high power rifles. In fact, some debris from landers with heavy cargo might even achieve orbital velocities, with potential to cause lethal harm to crew and exposed surface assets like solar power arrays and observatories, many miles from the landing zone, and even threaten orbiting spacecraft. So it is essential that we find ways to avoid this problem. One way to service landers is to build sturdy, dust-free landing pads. Robots capable of such extraterrestrial construction activity are being developed and NASA is studying such landing pads.

To be safe, the Artemis Accords proposes setting up a global registry for all parties planning ambitious lunar missions, not only to avoid such accidents, but also calls for a concerted effort to save lives in case our astronauts suffer an anomaly that needs emergency rescue measures. Unlike on Earth, if things go wrong on the surface of the Moon, we will need the whole world to literally pull for us.



Lunar Landing pads will prevent landers from raising dust and debris that can have lethal consequences for astronauts and also destroy sensitive exposed assets like telescopes and other observatories. Sturdy landing pads on the Moon may be built using state of the art robots using 3D printing technologies.

Now our Moon beckons us to go back there, not as a symbol of national prowess or military might, not just out of scientific curiosity or as a marvel of technology, but to simply unite our species with an eye toward global harmony and peace. After all, our Moon has watched our planet from close to birth, turning from a ball of fiery molten lava and rugged rock, seen her pummeled time and again, only to transform into the vibrant blue orb with all the bounty that we now cherish.

By going back to our Moon, perhaps we can make our Moon a mirror for Earth, alive with life, liberty and the pursuit of happiness that we cherish, and constantly remind us, the stewards of Earth, how precious our biosphere is, all in the middle of the vast dark void of space. Spaceship Earth, the term that the polymath Buckminster Fuller coined back in the ‘60s could have a most benign, silent but ever watchful sister in our Moon, the same “sora Luna” that Francis of Assisi pays homage to in the song Laudes Creaturarum.

As Norman Cousins observed after the Apollo moon landing, “What was most significant about the lunar voyage was not that men set foot on the Moon, but that they set eye on the Earth”. Looking beyond the current pandemic, we see our Moon shining ever so cool and bright, enriching our lives, enhancing our culture with poetry and song and dance, and most of all, greeting us, a welcome sight, even on a most dreary night.

(Continued on Page 29)

Cultural Significance of Our Moon *(Continued from Page 28)*

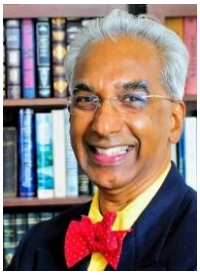
Our Moon A Symbol of Freedom

[M.Thangavelu USC SeleneOption 2016]

https://sites.google.com/a/usc.edu/aste527/home

Poetry and free speech make us Whole
Freedom of Art and Music and Dance warm our Soul
Aspire to our cherished values of Freedom
Beyond Science and Technology pursuit in the free world
Are Symbols of Freedom
Our Moon a Symbol of Freedom
Our Moon is that glorious orb in the night sky
Splendor shared by all alive
Not the International Space Station
Or the East river seat of UN in NY
Our Moon greets all Humanity all the time
Our Moon is a Symbol of Freedom
Hold hands, hug and sing and dance on our Moon
The Eighth continent come alive
Whole world watch in awe, laugh and cry
Life Liberty and the Pursuit of Happiness
Light up and come alive
E pluribus Unum is real, it's here, hear, hear
New world beckon from up above
Our Moon a Symbol of Freedom

About the Author:



MADHU THANGAVELU

DEPARTMENT OF ASTRONAUTICAL ENGINEERING, VITERBI SCHOOL OF ENGINEERING & SCHOOL OF ARCHITECTURE, UNIVERSITY OF SOUTHERN CALIFORNIA, NATIONAL SPACE SOCIETY BOARD OF DIRECTORS

Madhu Thangavelu conducts the ASTE527 graduate Space Exploration Architectures Concept Synthesis Studio in the Department of Astronautical Engineering within the Viterbi School of Engineering, and he is also a graduate thesis adviser in the School of Architecture at USC. He holds degrees in both engineering and architecture and has contributed extensively to concepts in space architecture, especially dealing with extraterrestrial development. He is the author or co-author of over 70 technical papers in space architecture, lunar base design and human factors, and co-author of the book The Moon: Resources, Future Development and Settlement (1999) published by John Wiley and Sons and the second edition by Springer/Praxis in 2007. He is the invited author of the chapter "Living on the Moon" in the Encyclopedia of Aerospace Engineering, a major reference work published by John Wiley and Sons in 2010 and the online second edition updated in 2012. He is a member of the USC team that won the NASA NIAC Phase I award in 2011 and Phase II award in 2012. As a former AIAA officer, he served as Vice Chair for Education in the Los Angeles section. He is on the faculty of the International Space University, an international organization that provides training for a promising new generation of leaders and space professionals around the world.
He is a strong advocate for articulating the philosophy of space: Scientists and Engineers(in particular) have a tendency to get lost in the tools and toys they make, though some of us do arrive at philosophy for the meaning of what we do and why, via the long route of experience. By then, alas, for the most part, our life's work is done. It is a good idea to set us all on a solid foundation in space philosophy, so we can all have a steady handle on our works, as nature reveals her secrets… slowly, ever so slowly, but surely…

Websites of interest:

https://classes.pvnet.com/description?id=326

https://pressroom.usc.edu/madhu-thangavelu/

https://sites.google.com/a/usc.edu/aste527/home

https://isdc2019.nss.org/home/schedule/sessions/moon/

https://mmp.planetary.org/artis/thanm/thanm70.htm

Prof. Thangavelu will be leading the AIAA LA-LV Space Architecture Gathering 2020 on August 22, 2020. (conta.cc/3f9jJYT), and also presenting on June 27, 2020 during the PDAE mini-Conference 2020 (conta.cc/2AjrMUh). See pages 34, 41 in this newsletter.

AIAA Member Spotlight Summary (29 May, 2020 – 17 June, 2020) *(2 June, 2020)*

Dr. Azad M. Madni

"Entrepreneur, Researcher, Educator, Mentor"

AIAA Fellow

Professor, Astronautical Engineering

Executive Director, System Architecting & Engineering Program

Director, Distributed Autonomy and Intelligent Systems Laboratory,

University of Southern California

Azad M. Madni is an entrepreneur, researcher, educator, author, and mentor. An AIAA Fellow and AIAA/ASEE Leland Atwood Award recipient, he is currently a Professor of Astronautical Engineering and Executive Director of Systems Architecting and Engineering Program at the University of Southern California. He is the founder and CEO of Intelligent Systems Technology, Inc., a high-tech R&D company specializing in simulation-based training and intelligent decision aiding technologies for defense, aerospace, and automotive industries.

Inspired by President Kennedy's "we choose to go to the moon" speech in 1962 while in Mumbai, India, he decided early on that he wanted to be part of the space program. He came to the US as an undergraduate and earned a BS degree in engineering from UCLA. He began working for The Ralph M. Parsons Co on defense programs while simultaneously earning his MS in Engineering from UCLA. He returned to UCLA full-time to begin work on his doctorate degree. A few months into the program, he was recruited by Rockwell International to work on NASA's Space Shuttle Program. It was a dream come true.

He began work at Rockwell as the lead engineer for the Shuttle Entry and Terminal Area Energy Management (TAEM) navigation studies. In this capacity, he made several key technical contributions to the design of the shuttle navigation system including the development of stochastic error models for navigation sensors. His signature contribution to the Shuttle Program was an innovative, probabilistic model-based approach to navigation system performance testing that produced significant cost savings for Rockwell in navigation system testing for the Shuttle orbiter's Approach Landing Tests and Orbital Flight Tests. For these important contribution, he received five Technology Utilization Awards from Rockwell and a NASA commendation.

In 1977, he was recruited by his advisor to head up the R&D group of Perceptronics, a UCLA startup. He joined the company and was able to contribute right away in a leadership position. He led the company's R&D in AI and human-machine systems, game-based training simulators, and distributed, virtual reality-enabled simulation-based training systems. He rose to the position of Executive VP for R&D and Chief Technology Officer of the Company. The company experienced impressive growth and was successful in going public. Shortly thereafter, he decided to start his own hi-tech company.

In 1994, he founded Intelligent Systems Technology, Inc., to conduct R&D in innovative uses of AI in complex systems engineering and interactive storytelling simulations for education and training. As CEO, he was successful in growing the company 1588% in the first five years garnering numerous awards and honors. He had created award-winning products and was the recipient of SBA's National Tibbetts Award for California. He went on the win Developer of the Year from the Software Council of Southern California in 2000 and 2004.

In 2006, he was recruited by the University of Southern California (USC) to assume the leadership of the Systems Architecting and Engineering Program as Director and full professor. He accepted the position in 2009. Under his leadership, the program became a top-rated graduate program in Systems Engineering in the country. In 2016, Boeing honored him with a Lifetime Achievement Award and a Visionary Systems Engineering Leadership Award for his "impact on Boeing, the aerospace industry, and the nation." He is also the founding director of USC's doctoral program in Systems Architecting and Engineering within the Astronautical Engineering Department.

(Continued on Page 31)

AIAA Member Spotlight Summary (29 May, 2020 – 17 June, 2020) (2 June, 2020)

(Continued from Page 30)

He pioneered the field of transdisciplinary systems engineering and wrote an award-winning book on the subject, *Transdisciplinary Systems Engineering: Exploiting Convergence in a Hyper-Connected World* (foreword by Norm Augustine), Springer 2018. He is the co-author of *Tradeoff Decisions in System Design*, Springer, 2016, Co-Editor-in-Chief of two CSER research volumes, and Editor of MDPI *Systems* special issue on Model Based Systems Engineering. An ardent STEM advocate and member of USC Provost's STEM Steering Committee, he has mentored several aspiring entrepreneurs and students especially from under-represented groups since 1994. He conducts research in intelligent systems, distributed autonomy, formal and probabilistic methods, and machine learning in complex systems modeling.

He is a Life Fellow of IEEE, INCOSE, SDPS, IETE, and Fellow of AIAA and AAAS. He is the recipient of numerous awards and honors including prestigious international awards from eight different professional societies. In 2011, he received the *INCOSE Pioneer* Award. In 2019, he received the *IEEE Aerospace and Electronic Systems Pioneer Award*, the *AIAA/ASEE John Leland Atwood Award, the ASME CIE Leadership Award, the INCOSE Founders Award,* and *the Society of Modeling and Simulation International's Presidential Award.*

References:

Azad Madni Recognized for Lasting Contributions to Advances in Aerospace Systems

https://viterbischool.usc.edu/news/2020/05/azad-madni-receives-the-institute-of-electrical-and-electronics-engineers-aerospace-and-electronics-systems-societys-highest-honor/

INCOSE Fellow honored with IEEE Aerospace and Electronic Systems Pioneer Award

https://www.incose.org/events-and-news/incose-and-se-news/2020/04/20/incose-fellow-honored-with-ieee-aerospace-and-electronic-systems-pioneer-award

2019 IEEE Aerospace and Electronic Systems Pioneer Award.

2019 - "For contributions to advanced simulation-based training and intelligent decision aiding for aerospace systems."

http://ieee-aess.org/membership/awards/society-pioneer-award

Azad Madni Receives 2019 ASME CIE Leadership Award

https://viterbischool.usc.edu/news/2019/08/azad-madni-receives-2019-asme-cie-leadership-award/

Azad Madni Receives the Prestigious INCOSE 2019 Founders Award

https://viterbischool.usc.edu/news/2019/09/azad-madni-receives-the-prestigious-incose-2019-founders-award/

Azad Madni Honored by Boeing at USC

https://viterbischool.usc.edu/news/2016/09/azad-madni-honored-boeing/

Society of Modeling and Simulation International's Presidential Award for Enabling the Modeling and Simulation Discipline

https://scs.org/scs-awards-and-recognition/

Collaborate Through Stories: Using Interactive Storytelling to Bridge the Gap Between Engineers and Stakeholders

https://viterbischool.usc.edu/news/2017/07/collaborate-stories-using-interactive-storytelling-bridge-gap-engineers-stakeholders/

INCOSE Fellow Azad M. Madni Receives Prestigious Awards from Orange County Engineering Council

https://www.incose.org/incose-member-resources/chapters-groups/ChapterSites/charleston/chapter-news/2019/05/13/incose-fellow-azad-m.-madni-receives-prestigious-awards-from-orange-county-engineering-council

Azad Madni Named an INCOSE Pioneer

https://news.usc.edu/29550/azad-madni-named-an-incose-pioneer/

Distinguished Industry CEO Azad Madni Joins Viterbi School

https://viterbi.usc.edu/news/news/2009/distinguished-industry-ceo.htm

Winners of the 2017 Engineers' Council Awards

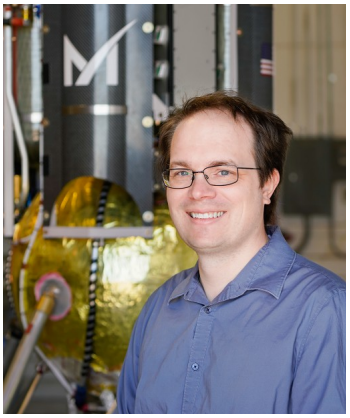
https://viterbischool.usc.edu/news/2017/03/winners-2017-engineers-council-awards/

Engineering Systems: A Convergence of Disciplines

https://viterbischool.usc.edu/news/2017/04/engineering-systems-convergence-disciplines/

AIAA Member Spotlight Summary (29 May, 2020 – 17 June, 2020)*(15 June, 2020)*

Matthew Kuhns



AIAA LA-LV Member

Chief Engineer,
Masten Space Systems, Inc.

I am a kid who never grew out of wanting to be an astronaut. Once I discovered you could build spaceships in addition to flying them, I was hooked. My father helped by teaching me about the planets and getting me a telescope when I was 10.

- In high school my drafting teacher Mr Bartman taught me a lot of the fundamentals of engineering. He came from the SR-71 program and we were all suitably impressed. He provided me with a solid pencil and paper drafting and CAD foundation which let me get my first engineering job in college.
- Education: University of Wisconsin - Madison, Engineering Mechanics 2008. Prof. Elder, Prof. Crone, and Prof. Lakes were a huge influence on helping me understand what it takes to be a good engineer.
- Graduating in 2008 felt like the worst time to try to find a job in space, so I went into the aircraft industry.
    - **PCC Airfoils - SMP Plant,** Wickliffe, OH. SMP manufactures single crystal turbine blades and combustor components for jet engines.
    - **General Atomics ASI,** Adelanto, CA. Propulsion R&D for the Predator C Avenger & PWC 545BM jet engine.
    - **Eaton Aerospace,** Irvine, CA. Mechanical & Electrical lead for an interdisciplinary Advanced Technology team.
- Masten gave me a chance to make the jump to space in 2015, and it has been a wild ride. Lots of testing, lots of rocket firings, and lots of amazing people. I started as a subsystem lead on Xephyr, Masten's reusable VTVL small sat launcher for the DARPA XS-1 program.
- The last few years have been so great for innovation and opportunities in the space industry, and I hope we can all weather the Covid-19 storm together. With so many launch vehicles available now, and more soon to be available, it's really going to infuse the space economy with extra energy. Particularly in cis-lunar space, extremely optimistic that we as industry can find a way to develop a sustainable economy which can help drive a permanent lunar presence.
- My current job with Masten is amazing, we work on building and flying rockets and now we are going to the moon. Working closely with NASA and their extremely skilled engineers is a continual source of inspiration. The projects we are working on will be able to increase performance and lower cost of propulsion and spacecraft hardware across the industry.
    - Chief Engineer, *XL-1 Lunar Lander*, NASA CLPS/Artemis
    - PI *MOWS for Surviving the Lunar Night*, NASA SBIR Phase I and II
    - PI *PermiAM Transpiration Cooled Rocket Engines*, NASA SBIR Phase I and II
    - PI *Rocket Plume Deep Cratering Physics*, NASA SBIR Phase I, II, and III
    - PI *25k Broadsword Tipping Point*, NASA Tipping Point Program
    - NIAC Fellow: *FAST Landing Pads for Artemis*, NASA Innovative Advanced Concepts Program
    - PI *Artemis E-Pump Technology Demonstration Program*, NASA
    - PI *E-Pump Development for Landers*, NASA MSFC CAN
- Patents
    - High Wing Fuel Compensation System (Eaton) USPTO 62/233,660
    - Magnetically Aligned Fuel Valve (Eaton) USPTO US20170708121A1
    - Fluid System with Differential Pressure Control (Eaton) USPTO US62/442,624
    - Method for Predicting Sunset Vibrancy (Skyfire) USPTO 62/097,001
    - PermiAM: Porous AM Material for Rockets (Masten) USPTO US16/372,401

I also enjoy photographing rocket launches, both at Masten and at KSC/Vandenberg! My space photography has been published by Aviation Week, Spaceflight Insider, NASA, Spacenews, Planetary Society, and Microsoft. My broader work has been published in a few books and publications like National Geographic, have had shows in several LA area galleries.

For fun, Ice Sat II launch at Vandenberg

One of my landscape images

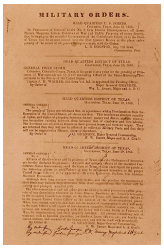
Volunteers are needed for all AIAA activities, please contact cgsonwane@gmail.com

AIAA LA LV e-Happy Hour

AIAA LA LV Celebrates

Juneteenth

with Tyrone Jacobs Jr.
and other Aerospace leaders
Friday, June 19, 2020, 6 PM - 7 PM (Add to Calendar)
RSVP and Information: conta.cc/3cZdmGg



Juneteenth is the oldest nationally celebrated commemoration of the ending of slavery in the United States. Dating back to 1865, it was on **June 19th** that the Union soldiers, led by **Major General Gordon Granger**, landed at **Galveston, Texas** with news that the war had ended and that the **enslaved were now free**. Note that this was **two and a half years after** President Lincoln's **Emancipation Proclamation** - which had **become official January 1, 1863**. The Emancipation Proclamation had little impact on the Texans due to the minimal number of Union troops to enforce the new **Executive Order**. However, with the **surrender of General Lee in April of 1865**, and the **arrival of General Granger's regiment,** the **forces** were finally strong enough to **influence** and **overcome the resistance.**

Tyrone Jacobs, Jr., 26 years old, was born in Chicago, IL. He is currently based in Los Angeles, CA. Tyrone strives to become the best speaker, engineer, leader, man, and person that he can be. His mission is to give hope to the hopeless. He aims to show people that, regardless of their past circumstances and environment, that, they can become successful and accomplish their wildest goals and dreams.

[events.aiaalalv@gmail.com] [http://aiaa-lalv.org/]

Volunteers are needed for all AIAA activities, please contact cgsonwane@gmail.com

e-Town Hall Meeting, June 20, 2020, 11:30 PM - 3:30 PM

(Add to Calendar)

(11:30 AM - 12:45 PM)

Building Resilience: How to navigate stress and crisis of COVID-19

by

Christi Garner LMFT , Trauma Therapist and Educator

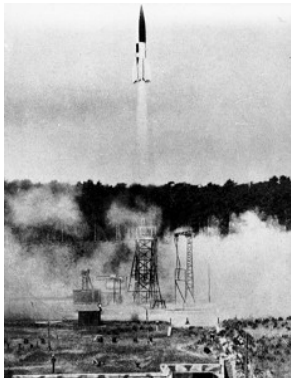
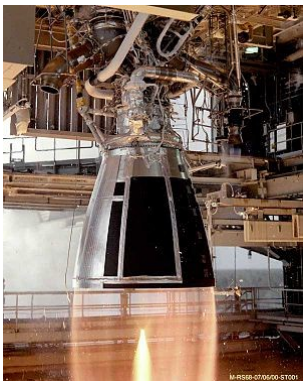
www.traumaeducator.com

A HISTORY OF ROCKETRY (1:00 PM - 3:30 PM)

by

John Halchak, Senior Fellow

Engineering department of Rocketdyne (now named Aerojet Rocketdyne)


RSVP and Information: conta.cc/3f38EK1

Building Resilience: How to navigate stress and crisis of COVID-19

Navigating stress and crisis are no longer topics only for first responders and front liners. We have all been impacted this year by pandemics, chaos, and uncertainty. In this presentation we will learn tools for building resilience in times of stress, mindful hacks to feel better today, stress busting techniques to use daily at home or at work to increase your ability to focus and recover from crisis and even tips on how to get better sleep. Practical tools and a place to ask questions while you learn about your body's innate ability to heal, even in times like these.

A HISTORY OF ROCKETRY

"Those who do not remember the past are condemned to repeat it" is the famous quotation of the philosopher George Santayana. For the engineer, knowing the mistakes of the past, including why they occurred, is a necessity to avoid repeating them. However, it also is important to know and understand past successes so that they may be stepping stones for future advances. Studying history also gives us a perspective of the present, helping us to understand why things are the way they are today and can point towards a path for change.

This talk will be a broad overview of the history of rocketry, with some emphasis on the importance of materials in the development of the technology. The American rocket pioneer, Dr. Robert H. Goddard, used some surprisingly advanced materials concepts for his rockets, combining metals and ceramics to achieve performance goals. Unfortunately, Goddard's paranoia combined with his inability to work with others, destroyed his legacy. In their V-2 ballistic missile of World War II, the Germans used a variety of materials, with wartime shortages necessitating some creative materials selections. The V-2, although ineffective as a weapon, had profound long-term consequences, as it jump started ballistic missiles and space exploration. The first American and Soviet rockets were essentially improvements on the German designs that also incorporated higher strength materials to reduce overall weight and increase performance.

Volunteers are needed for all AIAA activities, please contact: cgsonwane@gmail.com

Asteroid Day
Planetary Defense and Asteroid Exploration (PDAE)
e-mini-conference 2020

Saturday, June 27, 2020, 10 AM (Add to Calendar)

RSVP and Information: conta.cc/2AjrMUh

Dr. Nahum Melamed (moderator)
AIAA Distinguished Lecturer
Project Leader, The Aerospace Corporation
"Introduction and NEOs Deflection App brief demo"

Prof. Madhu Thangavelu
Director and Faculty Member, USC / ISU
"Evolving A Planetary Defense Capability through Orbital Debris Mitigation"
"Establishing An Earth-Moon Planetary Defense Architecture"

Dr. Makoto Yoshikawa
Program / Mission Manager
Institute of Space and Astronautical Science (ISAS) of
Japan Aerospace Exploration Agency (JAXA)
"The challenges of Hayabusa2"

Prof. Kevin McKeegan
Distinguished Professor
Institute of Geophysics and Planetary Physics
Department of Earth, Planetary, and Space Sciences
University of California, Los Angeles (UCLA)
"Asteroids and Meteorites"

Dr. Nereida Rodriguez-Alvarez
Research Scientist, Planetary Radar & Radio Science Group
NASA's Jet Propulsion Laboratory (JPL), California Institute of Technology (CalTech)
"Global Achievements of the Planetary Radar and Radio Sciences Group at JPL towards NEO Observations with the GSSR, and the results presented in the Blue Sky Study."

Atty. Jennifer S. Perdigao
Partner & Co-Chair, Tressler's Transportation Practice Group
Pilot
"Space Law in Planetary Defense, Asteroid Exploration, andSpace Debris"

Mr. Philip Groves
("Asteroid Impact" IMAX Producer & Writer, Apophis Pictures, LLC)
"Fostering public support for planetary defense through media"

Mr. Liam Kennedy
Inventor of the ISS-Above
Former President, Orange County Astronomers
Former Griffith Observatory Planetarium Lecturer
Former NASA/JPL Solar System Ambassador
"ISS-Above, a Raspberry Pi gizmo that presents a rich set of live information about the ISS including live video views of the earth"

Dr. Serena Goldstein
Naturopathic Doctor (both office & virtual)
www.drserenagoldstein.com
"Simple tips to find balance and a healthy lifestyle during COVID-19 & Crisis"

Nikola Schmidt, PhD.
Research Associate in Space and Cyber Politics
Head of the Centre for Governance of Emerging Technologies at the Institute of International Relations, Prague, CZ
Institute of Political Studies, Faculty of Social Sciences,
Charles University, Prague, CZ

[**events.aiaalalv@gmail.com**] [**http://aiaa-lalv.org/**]

Volunteers are needed for all AIAA activities, please contact: cgsonwane@gmail.com

e-Town Hall Meeting

July 11, 2020, 10 AM (Add to Calendar)

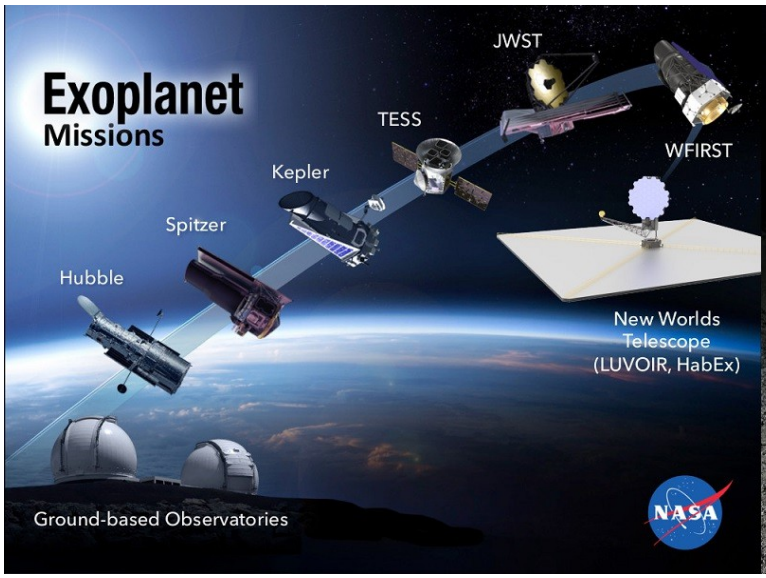
Towards Earth 2.0: Exoplanets and Future Space Telescopes

Dr. Aki Roberge, Research Astrophysicist
Exoplanets and Stellar Astrophysics Lab at
NASA's Goddard Space Flight Center
(currently on temporary detail to NASA HQ)

&

Making Space Accessible to the World

John Thornton, Chief Executive Officer of Astrobotic



RSVP and Information: conta.cc/2SvGyx7

Questions about Events/Program: events.aiaalalv@gmail.com

Volunteers are needed for all AIAA activities, please contact: cgsonwane@gmail.com

AIAA Los Angeles – Las Vegas
Honoring Aerospace African American Professionals

Saturday, July 11, 2020, 1 PM (Add to Calendar)

RSVP and Information: conta.cc/2Y9nZBo

Stephen Guine (moderator)
Northrop Grumman

Mike Wallace
Raytheon

Dr. Lindsay O'Brien Quarrie
Lindsay O'Brien Quarrie, BSEE, MSEE,
Ph.D. Materials Engineering
Chairman and Chief Technology Officer
Space Sciences Corporation Main Office

Tyrone Jacobs Jr.
Mr. Positive Vibes™ | Speaker | Engineer | Leader |
Content Creator | Storyteller |
Components Engineer, Boeing

Dr. Christianna Taylor (moderator)
Founder and CEO, Intelligence Space

Alondra Oubré, Ph.D.
Owner, Consultant Medical Writing

Darren Dupar
CEO and Owner, Twin Eng and Mfg, Inc.
Northrop Grumman - Retired

Ivor Dawson
Traveling Space Museum, Inc.

Moises Seraphin
Stäubli Electrical Connectors, Inc.

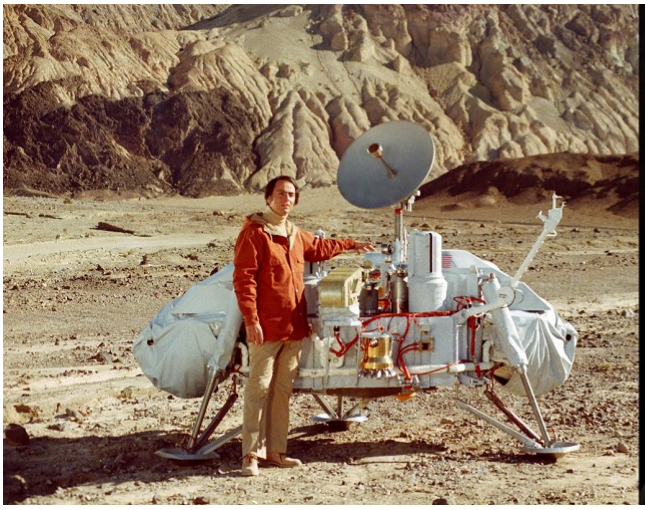
(More TBA)

[**events.aiaalalv@gmail.com**] [**http://aiaa-lalv.org/**]

Volunteers are needed for all AIAA activities, please contact: cgsonwane@gmail.com

(Online) July 18, 2020, 10 AM (Add to Calendar)

Apollo 11 (51st) and Vikings (44th) Anniversary 2020 (Neil's Day)



James R. French, JRF Consulting, AIAA Fellow

"Gone But Not Forgotten, The Test Stands for the Rocket Engines of Apollo"

Before they lofted the Saturn launch vehicles into space and landed the Lunar Module on the Moon, the rocket engines in these vehicles had to be tested on the ground. This was first done on test stands at Santa Susanna, Inglewood, and San Juan Capistrano California before moving on to Edwards Rocket Base and NASA facilities. These original stands are mostly gone now but they appear again in the pictures of this presentation. Jim French worked on these engines and test stands and shares his memories of those days.

Prof. David Barnhart, Director, USC ISI / SERC, Faculty Liason to RPL/LPL

"Moving Past Apollo: This generation's tools to build the 2nd major step for Mankind in Space"

(More Participants TBD)

RSVP and Information: conta.cc/2SMuHLl

Questions about Events/Program: events.aiaalalv@gmail.com

AIAA American Institute of Aeronautics and Astronautics Los Angeles - Las Vegas Section

aiaa-lalv.org | aiaa-lasvegas.org
engage.aiaa.org/losangeles-lasvegas

Volunteers are needed for all AAIAA activities, please contact: cgsonwane@gmail.com

e-Town Hall Meeting by AIAA & SCALACS

AIAA LA LV, AIAA OC, and SCALACS joint

August 1, 2020, 10 AM (Add to Calendar)

"The Energy Innovation and Carbon Dividend Act"

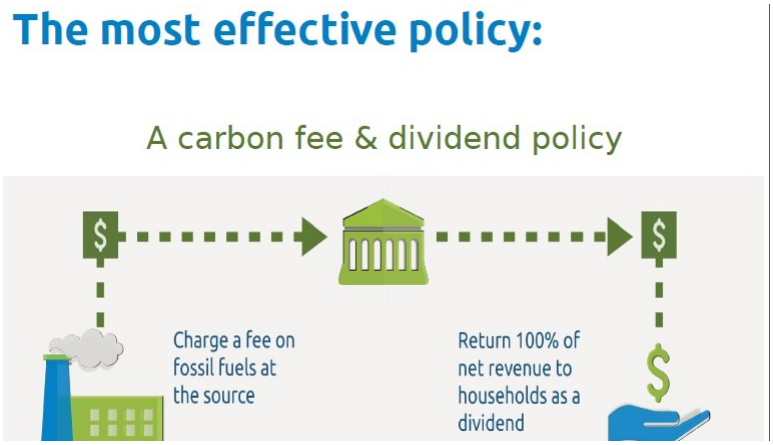
by

Dr. James A. Martin

Boeing - retired

AIAA Space Propulsion Steering Committee

RSVP and Information: conta.cc/3deyFnT



Dr. Martin holds degrees from West Virginia University, Massachusetts Institute of Technology, and George Washington University. He has worked at the NASA Langley Research Center, The University of Alabama, and Boeing. His work has mostly involved the design and evaluation of reusable launch vehicles and in-space propulsion.

Dr. Martin retired from Boeing when the launch vehicle business was sold. He served as an Associate Editor for AIAA J. Spacecraft and Rockets for 30 years. He continues to be active in aerospace doing consulting, on the Space Propulsion Steering Committee, and in the local AIAA Orange County Section Council. He is active with the Citizen's Climate Lobby.

"The Energy Innovation and Carbon Dividend Act"

The presentation will show the early history of temperature and carbon dioxide on Earth. It will show the real cause of climate change and how the nation can reduce climate change while stimulating the economy, protecting the poor, and pushing other nations to do the same.

[**events.aiaalalv@gmail.com**] [**http://aiaa-lalv.org/**]

Volunteers are needed for all AAIAA activities, please contact: cgsonwane@gmail.com

(Online) Saturday, August 8, 2020, 10 AM (Add to Calendar)

In-flight Refueling the SR-71 During the Cold War

by

Col. Charlie Vono (USAF-Retired)

RSVP and Information: conta.cc/2WdBwYF

This presentation is for any audience looking for a few good stories featuring our high tech Cold War weapon systems. As a KC-135Q aircraft commander, Charlie can relate firsthand what it meant to be a Cold Warrior, how the technology worked, and what he did when it didn't work. These were the days when we used sextants to cross the Pacific, engines blew up routinely, and no mission went entirely as planned. With most of this highly classified mission now de-classified, Charlie can spice up this Cold War stories with facts about the technologies and mission. A real crowd-pleaser, he always finds a few audience members who supported this mission and speak up with their own stories.

[events.aiaalalv@gmail.com] [http://aiaa-lalv.org/]

Volunteers are needed for all AAIAA activities, please contact: cgsonwane@gmail.com

Saturday, August 15, 2020, 10 AM (Add to Calendar)

Aerospace Women's Career Day Event

Recognizing the 100th anniversary of the passage of the 19th Amendment and Women's Contributions to STEM!

(Please check this link for more history on it: www.history.com/topics/womens-history/the-fight-for-womens-suffrage)

Please join AIAA LA LV to celebrate the auspicious month of August for Aerospace Women / Women's Career !

Both / All genders are welcome !

RSVP and Information: conta.cc/36EbzVD

Overall Chair / Moderator of this Event: Marilee Wheaton (Aerospace Corp., AIAA Fellow)

***Keynote Speaker: Marilee Wheaton (Aerospace Corporation, AIAA Fellow)**

***Main Women's (Career) Panel:**
Marilee Wheaton (Moderator/Panelist) (Aerospace Corporation, AIAA Fellow)
Michelle Rouch (Raytheon, Renowned Aerospace Artist)
Kris Acosta (Northrop Grumman, SWE-LA)
Janet Grondin (Stellar Solutions, Women in Defense (WID-LA) - President)
Dr. Claire Leon (Professor, Loyola Marymount University (LMU))
Courtney Best (Boeing, YP)

***Second Panel Women/YP Career Panel:**
Courtney Best (Boeing)(Moderator/Panelist)
Brett Cornick (Contractor)(AIAA LA-LV YP Chair)
Amanda Ireland (Boeing)
Jennifer S. Perdigao (Attorney, Pilot)
Dr. Anita Sengupta (Research Professor Astronautics, University of Southern California, Pilot)
Monica Maynard (LA School District STEM Director)
Roz Lowe (Manufacturing Industry Representative)
Sherry Stukes (NASA JPL)
Marilyn McPoland (CSUDH, AIAA LA-LV Council Member)
(More TBA)

***Resume Workshop and Interview Tips** (Fred Lawler, Raytheon)
***Why do girls/boys/general public want to go into / stay in Aerospace (and STEM) Career** (Bill Kelly, Aerojet-Rocketdyne-Retired)

More TBD.

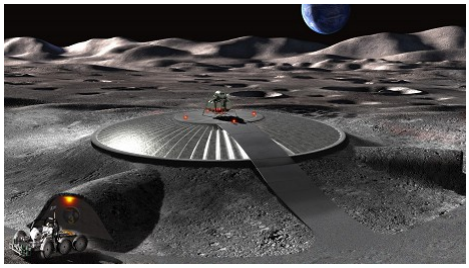
[**events.aiaalalv@gmail.com**] [**http://aiaa-lalv.org/**]

Volunteers are needed for all AAIAA activities, please contact: cgsonwane@gmail.com

AIAA Los Angeles-Las Vegas

Space Architecture Gathering

August 22, 2020, 10 AM (Add to Calendar)



RSVP and Information: conta.cc/3f9jJYT

Dr. Olga Bannova
Director, SICSA, College of Engineering, University of Houston
Chair, AIAA Space Architecture Technical Committee (SATC)

Barbara Belvisi
Founder and CEO of Interstellar Lab

Dr. Marc Cohen
Mission Architecture Lead at
Space Cooperative

Brand Griffin
Program Manager
Genesis Engineering Solutions
Member of AIAA Space Architecture Technical Committee (SATC)

A. Scott Howe, Ph.D.
Senior Systems Engineer, N3ASH
Jet Propulsion Laboratory (NASA / Caltech)

Dr. Barbara Imhof
Researcher, Univ. of Applied Arts Vienna
Professor, Universität Kassel

Kriss J. Kennedy
Architect, Space Architect
TECHNE` Architects, LLC
Adjunct Assistant Professor, University of Houston-SICSA

Mr. John Mankins
Vice President, Moon Village Association
Founder and President
Mankins Space Technology, Inc.

Jeffrey Montes
Senior Space Architect
BLUE ORIGIN

Anastasia Prosina
Founder & CEO at Stellar Amenities
Award-winning aspirational futurist and practitioner in Space Architecture

Mr. John Spencer
Outer Space Architect
Founder, President, Space Tourism Society (STS)
Co-Founder and Chief Designer: Mars World Enterprises, Inc. (MWE)
Co-Founder and President: Red Planet Ventures, Inc. (RPV)

Prof. Madhu Thangavelu
(Chair/Moderator of the Panel/Event)
Faculty Member, USC / ISU
Chair / Moderator of this Event

Melodie Yashar
Design Architect, Researcher and
co-founder of Space Exploration Architecture (SEArch+)

[**events.aiaalalv@gmail.com**] [**http://aiaa-lalv.org/**]

Volunteers are needed for all AAIAA activities, please contact: cgsonwane@gmail.com

AIAA LA LV STEM K-12 Meeting
with Alan Chan, and Cornelius Neil Cosentino
Saturday, August 29, 2020, 10 AM (Add to Calendar)
RSVP and Information: conta.cc/2YcZEKL

Red Rover Planetary Driving Simulator

by
Alan Chan
A twenty-year visual effects veteran,
A screenwriter and director

Explore Martian terrain from the driver's seat of a futuristic Martian rover! RED ROVER uses real NASA HiRISE satellite data and images in a game engine to create a simulator that lets you drive around and explore! It's a great opportunity for K-12 kids or students to see Mars up close and personal as guest speaker Alan Chan, the developer of Red Rover, takes us through each of the different areas of Mars available in this simulator

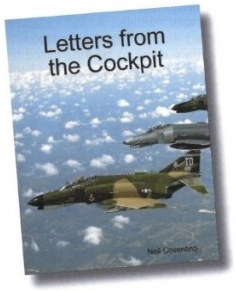
www.youtube.com/watch?v=1QAwRH1wrZ0

www.digitaltrends.com/cool-tech/red-rover-exploring-mars/

Letters from the Cockpit

by
Maj. Cornelius Neil Cosentino

Experienced Pilot, USAF-Retired



This inspiring talk is for those who wish they were born with wings, and/or enjoy short stories. Come fly with the speaker (Neil) as he relives his experiences as a high-time pilot with a knowledge of flight we all envy. Strap on the shoulder harness, tighten the seat belt-"CLEAR, Contact, "we can hear the roar of the engine as we taxi out -each story a new new exciting true adventure by a pilot who has been there !

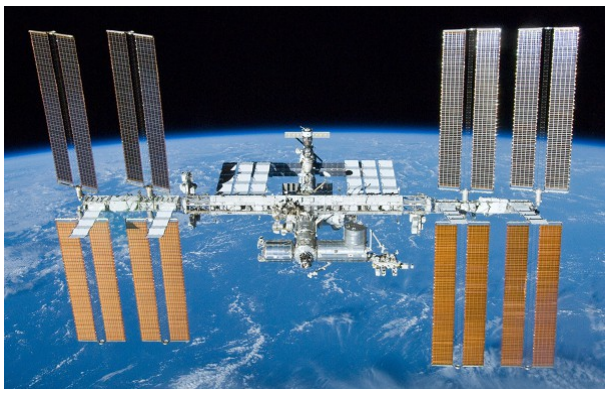
Neil will talk about why he wrote the short story book. He will also talk about writing a second short story book and why he categorized them as " Familographies " - the purpose is to encourage students to start writing their true stories.

[AIAA LA-LV K-12 STEM Chair: Casey Moninghoff cmoning@g.clemson.edu] [http://aiaa-lalv.org/]

Volunteers are needed for all AIAA activities, please contact cgsonwane@gmail.com

Saturday, September 5, 2020 (Add to Calendar)

RSVP and Information: conta.cc/3eMyMrp



International Space Station's critical role in enabling human exploration beyond low Earth orbit

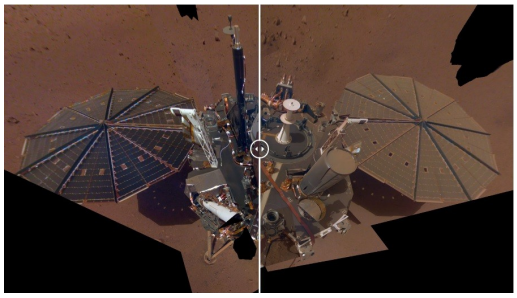
by

Dr. William H. Gerstenmaier

SpaceX, AIAA Honorary Fellow

Former Associate Administrator for the Human Exploration and Operations Mission Directorate (NASA HQ)

and



The InSight Mission to Mars

by

JPL Mission Principal Investigator

Dr. Bruce Banerdt

Jet Propulsion Laboratory

(Landed at Elysium Planitia on November 26, 2018)

Introduction to GPS and Pre-History of GPS

by

Frank Czopek

- Has worked Space and armor systems for all his career
- 35 years on GPS
- Hired at the start of the GPS operational era
- Held numerous jobs on GPS from Responsible Engineer to Program Manager
- Unofficial GPS Space historian

[events.aiaalalv@gmail.com] [http://aiaa-lalv.org/]

AIAA LA-LV Young Professionals Meetings

Mars Rover Rocket Launch Watch Party (6-7am July 17th, 2020)
Join us for an early morning launch watch party before work on July 17th to watch as NASA's Mars 2020 rover launches to the Red Planet on a ULA Atlas V rocket from Cape Canaveral. The Young Professionals of AIAA will be hosting a web meeting where we can converse, drink coffee, and watch the launch together! All are welcome to attend!

*Note: date and time are subject to change if the launch date changes.
For any questions about the event, please contact the LA/LV Young Professionals Chair, Brett Cornick, at brettcornick@gmail.com.

Young Professionals Virtual Trivia Night (6:30-8pm July 27th, 2020)
The AIAA LA/LV Young Professionals are hosting an online trivia night on July 27th with prizes available for first place! Come prepared for a battle of brains with all of your knowledge about aerospace, AIAA, and beyond! If you would like to submit your own trivia questions to be asked during the event, send them to the contact information below. Hope to see you there!

For any questions about the event, or to submit your own trivia questions, please contact the LA/LV Young Professionals Chair, Brett Cornick, at brettcornick@gmail.com.

Young Professionals Happy Hour Event (6:30-8pm Aug. 14th, 2020)
The AIAA LA/LV Young Professionals are hosting a new format of their popular online Happy Hour event at 6:30pm on August 14th. This event will group attendees into smaller, more focused groups of 4-6 individuals based on their career paths, research interests, and hobbies to help with networking and to facilitate meaningful connections and conversations between members. We encourage all AIAA members, including both young and seasoned professionals, to participate. If you are interested in attending, please RSVP by completing the survey at the link below. This event will be limited to 40 participants so please only fill out the form if you are serious about attending!

AIAA Focused Happy Hour Event Survey

For any questions about the event, or to cancel your RSVP, please contact the LA/LV Young Professionals Chair, Brett Cornick, at brettcornick@gmail.com.

SpaceX Crew Dragon Rocket Launch Watch Party (Time TBA Aug. 30th, 2020)
Join us on July 30th as we watch SpaceX launch its first operational Crew Dragon mission to the ISS with NASA astronauts Michael Hopkins, Victor Glover, and Shannon Walker and Japan's Soichi Noguchi. The mission will launch from NASA's Kennedy Space Center on a SpaceX Falcon 9 rocket. The Young Professionals of AIAA will be hosting a web meeting where we can converse, tell stories, and watch the launch together! All are welcome to attend!

*Note: date and time are subject to change if the launch date changes.
For any questions about the event, please contact the LA/LV Young Professionals Chair, Brett Cornick, at brettcornick@gmail.com.

AIAA National Forums & Events (June-August 2020)

(All remaining AIAA National Forums and Events in 2020 will go virtual / be online.)

*15-19 June, 2020 (Online), AIAA Aviation Forum, https://www.aiaa.org/aviation

*23 June, 2020, 1300 - 1430 (EDT), Live Panel Discussion: Staking Your Claim to the Trillion-Dollar Space Economy (Free Webinar) (Link)
*24 June, 2020, 1000 - 1100 (EDT), Aerospace Career Pathways – Academia (Member Exclusive Webinar)(Link)
*29 June, 2020, 1100 - 1200 (EDT), Briefing: NASA's Jim Reuter (Free Webinar) (Link)
*13 July, 2020, 1000 - 1100 (EDT), Aerospace Career Pathways – Professional Engineering (Member Exclusive Webinar)(Link)
9-10 July, 2020, OpenFOAM CFD Foundations – Online Short Course (with AIAA Certificate)(Registration)
*8 July, 2020 (starting) Design of Electrified Propulsion Aircraft - Online Short Course (16 Hourss)(with AIAA Certificate)(Registration)
*5-28 August, 2020, Introduction to Multiscale Modeling of Composite Structures and Materials with MSG/SwiftComp – Online Short Course (20 Hours) (with AIAA Certificate)(Registration)
*18 August, 2020 1330 - 1430 (EDT), Aerospace Career Pathways – Entrepreneurship (Member Exclusive Webinar) (Link)
**24-26 August, 2020, AIAA Aviation Forum, https://www.aiaa.org/propulsionenergy*

Some Local 3rd Party Non-AIAA Events (June-August, 2020)

*18 June, 2020 (Online) (1pm-2pm EDT) (Aerospace Corporation) A New Era of Commercial Remote Sensing with Jamie Morin and Robert Cardillo, Aerospace Corporation (Registration)
*19 June, 2020 (Online) (8am-9am PDT) (The Aerospace & Defense Forum) The JPL VITAL Ventilator Project: A successful rapid response design and prototyping effort (Registration)
*22 June, 2020 (Online) (12pm-1pm) SWE-LA Virtual Series: D&I in the Remote Workplace (Link)
*23 June, 2020 (Online) (5:30pm-7m) SWE-LA Virtual Series: Working from Home with Children (Panel)(Link)
*24 June, 2020 (Online) (5:30pm-7m) SWE-LA Virtual Series: Leading Teams Remotely (Link)
*25 June, 2020 (Online) (9AM-4:30PM PDT) (AMP SoCal) Cybersecurity Training Online (Registration)
*25 June, 2020 (Online) (12pm-1pm) SWE-LA Virtual Series: The Stress Detox (Link)
*25 June, 2020 (Online) (1PM-2PM EDT) (Aerospace Corporation) Cislunar Stewardship: Planning for Sustainability and Cooperation with James Vedda and George Pollock (Registration)
*26 June, 2020 (Online) (5:30pm-7m) SWE-LA Virtual Series: Dual Career Couples (Panel) (Panel)(Link)
*2 July, 2020 (Online) (1PM-2PM EDT) (Aerospace Corporation) The Future of Commercial Space Flight with Jamie Morin and Charlie Bolden (Registration)

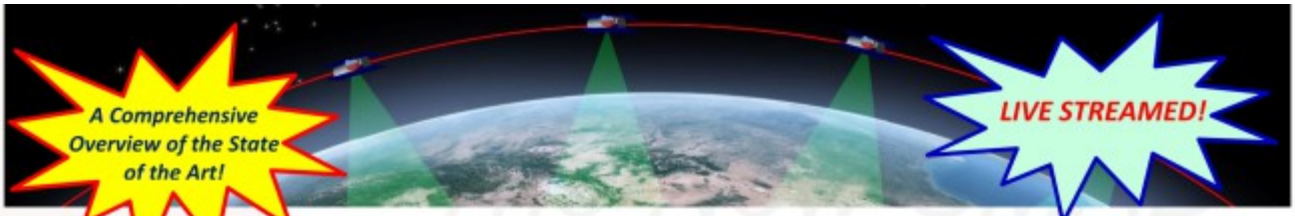
****25 July, 2020 (Online) (Starting 9 AM Pacific Time), Satellites and Education Conference XXXIII (Registration)***

(AIAA LA-LV Section Exhibition in this online event)

See what's happening on our social sites: Please join us, take a look, and invite others!volunteers are needed for social media, please contact cgsonwane@gmail.com

Engage @ AIAA LA LV AIAA LA-LV Website : AIAA-LALV.org

Please check out the new website features, comment/like for blogs and provide feedback. Also, if you are interested in writing blog or newsletter articles, please contact us. Please also follow, join, share, and/or like our social media pages, groups or pin boards.



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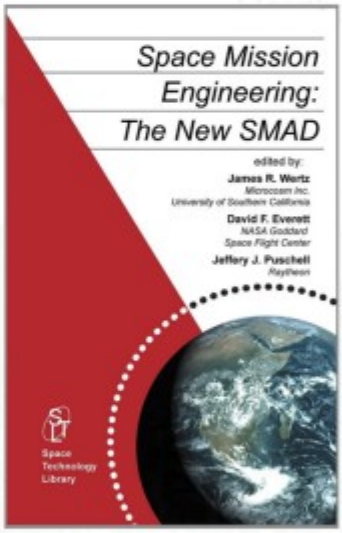

Course Schedule:
Mon - Fri (8:00 AM — 12 Noon)

Broadcast Live

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For more information:
Tel: 310-539-2306 or jjackson@smad.com

- Course Price: $2,500
- Course Material:
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For questions please contact the Course Administrator, Julie Jackson:

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