



LOS ANGELES - LAS VEGAS SECTION
DECEMBER, 2023

SHAPING THE FUTURE OF AEROSPACE



Vaughan

American Institute of Aeronautics and Astronautics
LOS ANGELES - LAS VEGAS SECTION

(Please click on the image or text in each of the items in the Table of Contents to jump directly to that section.)



4

The Aircraft Designers A Northrop Grumman Historical Perspective with Michael Ciminera (2023 December 7)

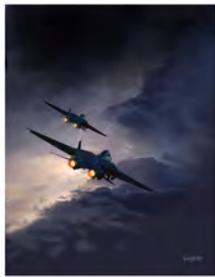


(Please click on the image or text in each of the items in the Table of Contents to jump directly to that section.)



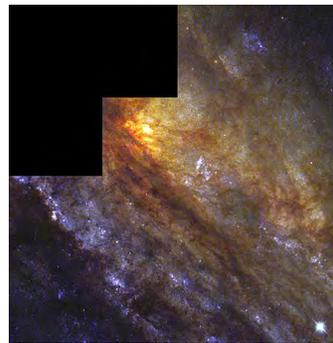
11

Sierra Space's Revolutionary Dream Chaser® Enters Final Test Campaign, Spaceplane Transitioning to Orbital Operations (2023 December 15)



13

Cover Page Description and Artwork Contributor



14

NGC 253, Caroline Herschel's galaxy (by Dr. David H. Levy)



16

Upcoming AIAA / LA-LV Events



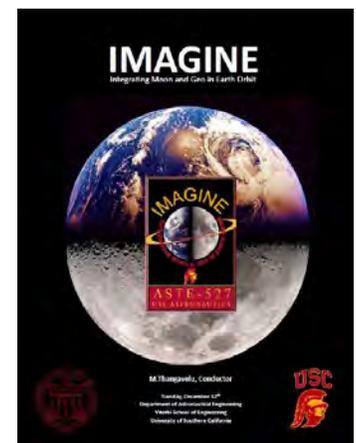
20

Astrobotic Peregrine Fueled & Ready for Lunar Mission (2023 December 19)



23

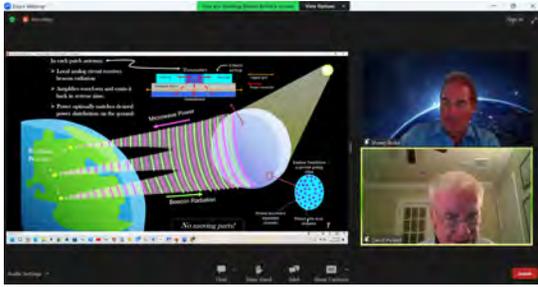
Commercialization of Space Biomedicine: How SpaceBox Accelerates Drug Screening in Microgravity (2023 December 9)



28

Introduction: IMAGINE: Integrating Moon and Geo in Earth Orbit (Prof. Madhu Thangavelu)

(Please click on the image or text in each of the items in the Table of Contents to jump directly to that section.)



31

SPACEPOWER-Star Shield, Proven & Patented Peacemaker for Peace On Earth & Above! (2023 December 12)



36

AIAA LA-LV Aero Alumni Meeting (2023 December 13)



37

Safe Is Not An Option: Overcoming The Futile Obsession With Getting Everyone Back Alive That Is Killing Our Expansion Into Space (2023 December 16)



42

AIAA Statement on Design/Build/Launch Student Experiments Onboard Successful Blue Origin New Shepard Mission (2023 December 19)



43

AIAA National 2023 Winter-Spring Course Catalog Released



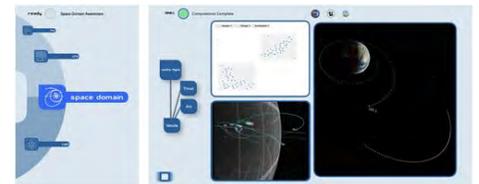
48

Welcome ! New AIAA Members! (LA-LV Section)



49

Aerospace News Digest



50

Space Force selects GURU and Princeton to Build the Future of Immersive Collaborative Training for Space Flight Operations (2023 December 18)

The Aircraft Designers A Northrop Grumman Historical Perspective with Michael Ciminera (2023 December 7) *(Photos only)*

(<https://www.aiaa-lalv.org/blogs/2023-blogs/2023-december/2023-december-7>)



(Left) Mr. Michael Ciminera used the rich body languages to explain and emphasize the key points in his presentation / lecture on the exciting stories about the histories of the Northrop Grumman aircraft and the designers..



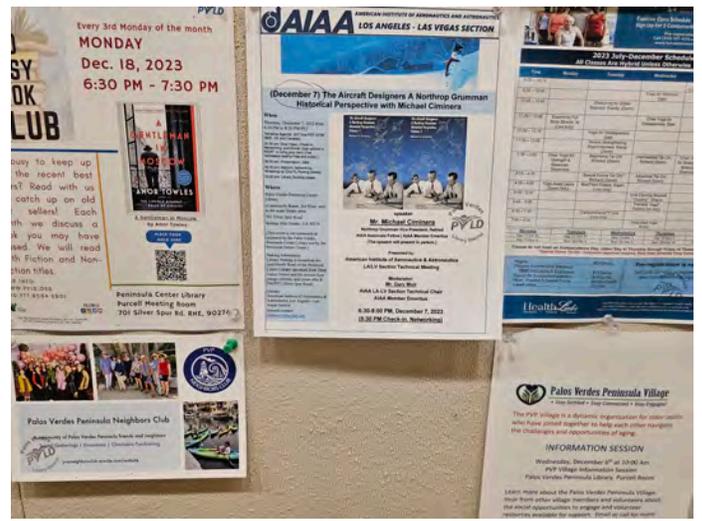
(Right) Dr. William Ballhaus (right) asked some very insightful questions, adding to the fun of the meeting / event, with other attendees listening attentively.

Disclaimer: The views of the speakers or authors do not represent the views of AIAA or the AIAA Los Angeles-Las Vegas Section. Advertising space is available in the AIAA Los Angeles-Las Vegas Newsletter: Business card, quarter page, half page, and full page, non-AIAA LA-LV 3rd-party business/issues

The newsletter has over 9,000 subscribers, and has been growing.

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The Aircraft Designers A Northrop Grumman Historical Perspective with Michael Ciminera (2023 December 7) *(Photos only)*



(Left) This meeting was listed on the TV Display. (Right) The Palos Verdes Peninsula Center Library posted the flyer provided by Mr. Gary Moir.



All set for greeting and welcoming attendees.



(Left) The speaker and some early-bird attendees chatted before the presentation. (Right) Ms. Joan Horvath showed the 3D-printed wings.

The Aircraft Designers A Northrop Grumman Historical Perspective with Michael Ciminera (2023 December 7) *(Photos only)*



Attendees listened to the presentation with great interests and attention.



Mr. Mike Ciminera emphasized it was a story of "we/us", and cited some of the key people in the Northrop Grumman aircraft design history.



(Left) A reunion of some of the aircraft designers in the presentation. (Right) Attendees could not wait for asking questions.

(Nov. 18) The Future of U.S. Robotic Planetary Exploration by Dr. Randii Wessen

(Photos Only)



Dr. William Ballhaus shared his views and experiences, and provided great insights.



Ms. Joan Horvath explained her questions and pointed to the importance of education.

(Nov. 18) The Future of U.S. Robotic Planetary Exploration by Dr. Randii Wessen (Photos Only)



Attendees asked very good questions and gave very positive comments, and interacted with the speaker and other attendees.



(Left) Mr. Mike Ciminera just received the newly published books from AIAA. (Right) Attendees continued to listen and ask questions.



(Left) Mr. Gary Moir moderated the meeting. (Right) The speaker continued to address the questions from the attendees.

(Nov. 18) The Future of U.S. Robotic Planetary Exploration by Dr. Randii Wessen

(Photos Only)



(Left) Mr. Gary Moir presented the speaker with the AIAA LA-LV appreciation certificate. (Right) More questions from some attendees.



(Networking after the exciting presentation.)



(Continued networking, as people still felt quite excited.)

Sierra Space’s Revolutionary Dream Chaser® Enters Final Test Campaign, Spaceplane Transitioning to Orbital Operations *(by Sierra Space, 2023 Dec. 15, with permission)*

<https://www.sierraspace.com/newsroom/press-releases/dream-chaser-spaceplane-enters-final-test-campaign>



Wings Are Back

LOUISVILLE, Colo. – Dec. 15, 2023 – Sierra Space, a leading commercial space company building the first end-to-end business and technology platform in space to benefit of life on Earth, has delivered the first Dream Chaser spaceplane, Tenacity, to NASA’s Neil Armstrong Test Facility in Sandusky, Ohio.

Dream Chaser, the world’s only commercial spaceplane, has entered the final testing phase ahead of its first flight in 2024. The testing campaign will confirm the spacecraft’s resilience to the challenges of launch and the demanding conditions of space as it prepares for its inaugural mission to the International Space Station under a multi-mission NASA contract.



Dream Chaser joins Sierra Space’s cargo module, Shooting Star™, which arrived at the NASA test facility in November. The two vehicles are set to be stacked in launch configuration and undergo rigorous environmental testing starting in the Mechanical Vibration Facility. The test will subject them to the extreme conditions of launch vibrations on the world’s most powerful spacecraft shaker table.

Sierra Space is unwavering in its commitment to ensuring the utmost reliability of its cutting-edge technologies. Dream Chaser, crafted in tandem with the groundbreaking Shooting Star cargo module, will reinvent space transportation and usher in the burgeoning era of space commercialization known as the Orbital Age®.

Sierra Space's Revolutionary Dream Chaser® Enters Final Test Campaign, Spaceplane Transitioning to Orbital Operations

“At Sierra Space, we are ushering in the next industrial revolution with a business and technology platform that provides our customers with a complete turn-key solution offering space as a service,” said Sierra Space CEO Tom Vice. “Our platform includes Dream Chaser, a revolutionary, highly reusable commercial spaceplane with global runway access, and the first business-ready commercial space station, leveraging the most advanced expandable structural architecture that will exponentially decrease the cost of product development and manufacturing in space.”

Sierra Space is Revolutionizing Space Transportation – Dream Chaser's Unique Capabilities:

- No More Plunging into the Ocean – Dream Chaser Uses the World's Global Commercial Runways
- Designed To Be Highly Reusable – Minimum 15 Missions Per System
- Fully Autonomous Operations
- High-Capacity Up Mass and Down Mass Payloads (Pressurized & Unpressurized)
- Low G Landings – Better for Science, Cargo and Crew
- Fast Access to Payloads and Science Upon Landing – Easy to Integrate into Ground Logistics
- Breakthrough Green Hydrogen Peroxide-Based Propulsion System
- Second Dream Chaser Vehicle, Reverence, In Production

Selected by a NASA contract:

Dream Chaser was selected by NASA for cargo delivery, return and disposal service for the International Space Station under the Commercial Resupply Services-2 (CRS-2) contract.

High reusability and flexibility:

Dream Chaser's highly customizable design makes it ideal for a range of applications, providing fast turnaround times to support various LEO needs. The fleet will provide greater efficiencies with high reusability and mark the beginning of a new era of space commercialization. The multi-mission spaceplane fleet is designed to transport crew and cargo to Low Earth Orbit (LEO) and can be customized for both domestic and international customers for global operations.

NASA's Neil Armstrong Test Facility:

NASA's [Neil Armstrong Test Facility](#) is part of NASA's Glenn Research Center in Cleveland. Located on 6,400 acres in Sandusky, Ohio, it is home to some of the world's largest and most capable space simulation test facilities, where ground tests are conducted for the U.S. and international space and aeronautics communities.

About Sierra Space

Sierra Space is a leading commercial space company at the forefront of innovation and the commercialization of space in the Orbital Age®, building an end-to-end business and technology platform in space to benefit life on Earth. With more than 30 years and 500 missions of space flight heritage, the company is reinventing both space transportation with [Dream Chaser®](#), the world's only commercial spaceplane, and the future of space destinations with the company's inflatable and expandable space station technology. Highly scalable and flexible, this innovative “softgoods” technology will define a new generation of space stations. Sierra Space also builds and delivers a host of systems and subsystems across solar power, mechanics and motion control, environmental control, life support, propulsion and thermal control, offering myriad space-as-a-service solutions for the new space economy.

Cover Page Description and Artwork Contributor



COVER-

Grumman F-14 'Tomcats'
U.S. Navy; 1974 - 2006

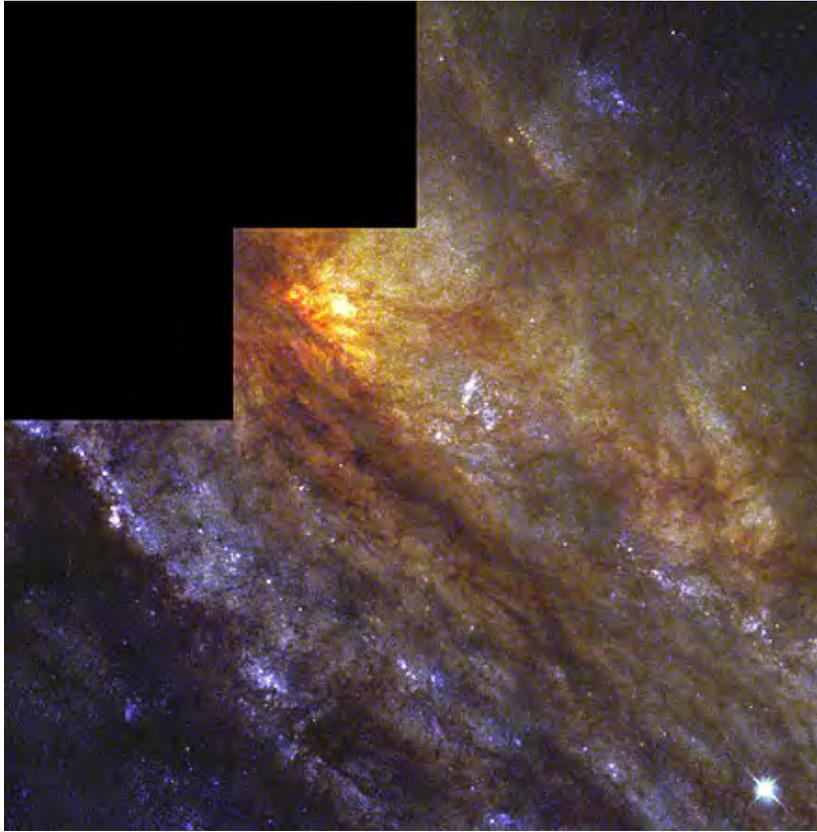
art work by: JAMES VAUGHAN

<https://jamesvaughanphotoillus.com/>

<https://jamesvaughanphotoillus.com/>

NGC 253, Caroline Herschel's galaxy

by Dr. David H. Levy, Comet and Asteroid Hunter, Co-Discoverer, Shoemaker-Levy 9 (2024 January article)



NGC 253

This month let us explore one of the seminal galaxies in the night sky, NGC 253, Caroline Herschel's galaxy. It shines deep in the southern portion of the sky, south of the bright star Beta Ceti and southeast of the even brighter star Fomalhaut. This is one of my favorite galaxies, largely because of the beautiful story that is associated with its discovery.

This galaxy, which I call Caroline Herschel's Galaxy, is a starburst galaxy. It is so named because it is undergoing a burst of formation of new stars. This process was set off relatively recently, at least in cosmic timekeeping. About two hundred million years ago, a smaller dwarf galaxy probably collided with this larger one, and it set off this cacophony of new stars being formed. That other galaxy was probably rich in gas, which provided the raw material for the births of the new stars. There is one thing that this galaxy does not share with other starburst galaxies, however; usually these galaxies exhibit frequent exploding stars or supernovae. This one, however, has only one recorded supernova, in 1940.

NGC 253, Caroline Herschel's galaxy

This galaxy is aligned at almost right angles to our Milky Way. When you look at it, it appears as a thick pencil-like structure.

While searching for comets during the year 1783, Caroline stumbled across this long, slender galaxy hanging above the southern horizon. Duly recorded in her log “the Bills and Rec.ds of my comets,” she also began and maintained a list or catalogue of the many objects she and her brother William had discovered, including beautiful drawings of most of them. As a young girl Caroline was close to her father, who brought her outdoors on a cold evening some winter constellations like Orion. It is possible that this was one of the special moments during which she began her love of the night sky.

As much as Caroline enjoyed working with her brother William, there were some issues. On one night Caroline fell upon one of the large iron hooks that helped support the telescope on its mount. The accident left a large gush in her thigh. Her brother, not seeing his telescope moving, yelled out “Make haste!” to which Caroline cried out, “I am hooked!” William immediately rushed over to help his sister, and she eventually recovered, with lots of rest and ointment.

When William married Mary Pitt in 1788, there was an obvious increase in tension among the Herschels. She continued working with her brother, although the increased “family dynamics” did cause a problem. William very much wanted his sister to continue helping with his observing, and he was successful in arranging a royal stipend for her.

In 1802 the Royal Society published the catalogue that Caroline had kept over many years. However, the publication in *Philosophical Transactions of the Royal Society* was credited to William, even though it was her catalogue. Over a long period of time, thanks to the work of later astronomers like John Louis Emil Dreyer, the almost 8000 objects now comprise the *New General Catalogue*.

The woman who discovered the wonderful galaxy in Sculptor certainly enjoyed a remarkable life and career, living until she was almost 98 years old. In the 1980s Caroline's eight comet discoveries were surpassed by Carolyn Shoemaker, in what was seen at the time as the highlight of Carolyn's career. However exciting that achievement might have been, it was completely eclipsed by her discovery of Comet Shoemaker-Levy 9 in March of 1993. That comet gave humanity its first lesson in what happens when a comet strikes a planet, and by inference, how comet collisions can lead to the origin of life on a world. As I gaze upon Caroline Herschel's galaxy on these winter nights, I imagine life forms there looking back, trying as we do, to share our cosmic heritage.

Upcoming AIAA / LA-LV Events

(<https://www.aiaa-lalv.org/events/2023-events-program>)



2024 AIAA Science and Technology Forum and Exposition (AIAA SciTech Forum) 8 JANUARY - 12 JANUARY 2024

Orlando, Florida, USA

The AIAA SciTech Forum program covers the science, technologies, and policies that are shaping the future of aerospace. The forum is the largest event for aerospace research, development, and technology in the world.

[https://www.aiaa.org/events-learning/event/2024/01/08/default-calendar/2024-aiaa-science-and-technology-forum-and-exposition-\(aiaa-scitech-forum\)](https://www.aiaa.org/events-learning/event/2024/01/08/default-calendar/2024-aiaa-science-and-technology-forum-and-exposition-(aiaa-scitech-forum))

<https://www.aiaa.org/scitech>

Upcoming AIAA / LA-LV Events

AIAA LA-LV 1/11 Section Aero Alumni (Hybrid) Meeting

Wednesday, January 11, 2024, 11 AM - 1 PM PST (GMT -0800) (US and Canada)

Aero Alumni (aerospace retirees) Meeting

Zoom on-line meeting and in-person as well.

Our monthly Aero Alumni Zoom meeting is at 11 am PST (on-line and in-person) on January 11 (The 2nd Wednesday of January). It will be a hybrid meeting. "Aero Alumni" are retirees from aerospace industries. All public are welcome to attend. Open to public with free admission. Please Contact [Mr. Gary Moir](mailto:gary.moir@ingenuir.com) for your attendance, on-line or in-person.

In-Person in:

*Olive Garden Italian Restaurant
23442 Hawthorne Boulevard, Torrance, CA 90505*

(This meeting is not sponsored by the Olive Garden Italian Restaurant.)

(South of Hwy 405/105, West of Hwy 110, North of PCH 1, and East of PCH 1) (Near Zamperini Field in Torrance (TOA))

(Lunch/Food order in the restaurant on-site will be required for in-person attendees.)

Online on Zoom:

Join Zoom Meeting: <https://aiaa.zoom.us/j/85204003626?pwd=b0D0RZvSeVwHH0QZtedgFgRttbCwEE.1>

Meeting ID: 852 0400 3626

Passcode: 639080

One tap mobile

+16694449171,,85204003626# US

+17207072699,,85204003626# US (Denver)

Dial by your location

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+1 309 205 3325 US

+1 312 626 6799 US (Chicago)

+1 360 209 5623 US

+1 386 347 5053 US

877 853 5257 US Toll-free

888 475 4499 US Toll-free

Meeting ID:852 0400 3626

Find your local number: <https://aiaa.zoom.us/j/85204003626?pwd=b0D0RZvSeVwHH0QZtedgFgRttbCwEE.1>

Please contact Mr. Gary Moir (gary.moir@ingenuir.com)

Upcoming AIAA / LA-LV Events

RSVP and Information: (<https://conta.cc/3t2s6IP>)

AIAA LA-LV 1/20 Section Town Hall (Hybrid) Meeting

Saturday, January 20, 2024, 11 AM PST (US and Canada) (GMT -0800)

(with in-person and on-line attendance.)

U.S. Human Space Exploration – The First Two Decades

Dr. Patrick Ford

Senior Science Advisor/Chief Remote Pilot
Atkinson Aeronautics & Technology,
Adjunct Assistant Professor
Embry-Riddle Aeronautical University
College of Aviation, Department of Flight

(The speaker will present on-line.)



Physical Location

Lawndale Library (Meeting Room)

14615 Burin Ave., Lawndale, CA 90260

(South of 105 Hwy, East/North of 405 Hwy, East of Pacific Coast Hwy (1))
(Near SpaceX Hawthorne, and close to Northrop Grumman Space Park)
(also online on Zoom for a hybrid event)

(This event is not sponsored by the Lawndale Library)

Online on Zoom

(Please register /RSVP and you will receive the ticket with the Zoom link.
Please check Spam or Junk folder shortly after registration to make sure.
If not, please try using an alternative email address.)

Tentative Agenda: (All Time PST (GMT -0800)) (US and Canada)

- 10:15 am: Check-in, Networking
- 11:00 am: Introduction and welcome
- 11:05 am: Presentation + Q/A
- 12:45 pm: Networking
- 02:00 pm: (Leave the Meeting Room by 2 pm PST)

Disclaimer: The views of the speakers do not represent the views of AIAA or the AIAA Los Angeles-Las Vegas Section.

Contact: General Contact: contact@aiaa-lalv.org, Events/Program events.aiaalalv@gmail.com



Upcoming AIAA / LA-LV Events

RSVP and Information: (<https://conta.cc/3tX2WoX>)

AIAA LA-LV 1/27 Section Meeting
Saturday, January 27, 2024, 11 AM PST (Check-in) / 1 PM PST (Talk)

In the Line of Duty: Michael Adams and the X-15

Ms. Michelle Evans

Author, Bestseller "The X-15 Rocket Plane, Flying the First Wings into Space" Founder and President, Mach 25 Media (www.Mach25Media.com)

AIAA Distinguished Speaker

Writer, Photographer, and Communications Specialist in aerospace
 (The speaker will present in person.)



Location

Norwalk Regional Library, in the Meeting Room
 12350 Imperial Hwy
 Norwalk, CA 90650

Google Maps: <https://maps.app.goo.gl/41e8HHfPzd7EavSE6>
 (This event is not sponsored by the Norwalk Library)

(East of 5 Hwy / 605 Hwy, South of 60 Hwy / 605 Hwy, North of 5 Hwy / 91 Hwy, and West of 57 Hwy. Near the junction of 5 Hwy / Imperial Hwy and 5 Hwy / Norwalk Blvd.)

Tentative Agenda: (All Time PST (GMT -0800)) (US / Canada)

11:00 am: Check-in, Networking.

11:30 am: Documentary film "Research Project X-15" (25m)

12:00 pm Lunch for those who bring own's lunch.

Networking. Book-signing

12:55 pm: Welcome and Introduction

01:00 pm: Presentations and Q&A

02:30 pm: Documentary film "The Rocket Pilots" (75 min), commentary/further Q&A

04:00 pm: Adjourn. Networking.

05:00 pm: Leave meeting room by 5 pm.

Disclaimer: The views of the speakers do not represent the views of AIAA or the AIAA Los Angeles-Las Vegas Section.

Contact: General Contact: contact@aiaa-lalv.org, Events/Program events.aiaalav@gmail.com

Astrobotic Peregrine Fueled & Ready for Lunar Mission

Fueled and integrated with ULA's Vulcan rocket, Peregrine is targeting launch on January 8, 2024

(by Astrobotic, 2023 Dec. 19, with permission)



Photo Credit: United Launch Alliance

Pittsburgh, PA – December 19, 2023 – Astrobotic announced today their Peregrine lunar lander successfully completed all integration milestones and was mated with United Launch Alliance's Vulcan rocket payload adapter on November 16, 2023. After a 3-week campaign to fuel and complete final checkouts, the Peregrine spacecraft is ready to launch a historic mission to the Moon on January 8, 2024.

“I have high praise for the professionalism, dedication, and technical expertise demonstrated by the Astrobotic team throughout the complex multi-year Peregrine development program. Evolving Peregrine from a paper concept to a fully tested spacecraft ready for launch is a remarkable achievement for a small business,” said Sharad Bhaskaran, Peregrine Mission One Director.

Peregrine is Astrobotic's first lander mission, and the team plans to become the first commercial company to successfully land a spacecraft on the lunar surface. The lander carries a total of 20 payloads, or cargo, including 5 from NASA's Commercial Lunar Payload Services initiative. The payload teams have missions that vary from seeking indications of water-ice near the lunar surface to demonstrating a rover swarm. The lander also has several payloads representing humanity through artwork and historical artifacts.

“If you've been following the lunar industry, you understand landing on the Moon's surface is incredibly difficult. With that said, our team has continuously surpassed expectations and demonstrated incredible ingenuity during flight reviews, spacecraft testing, and major hardware integrations,” says John Thornton, Astrobotic CEO. “We are ready for launch, and for landing.”

After launch, Peregrine has a long checklist of milestones to complete on its way to the Moon. The first handful will be executed shortly after launch, when the spacecraft will separate from the rocket, power on, and establish communications with Earth. At this stage, telemetry flowed through the NASA Deep Space Network system to the Astrobotic Mission Control Center in Pittsburgh will start informing the mission control team of the spacecraft's position, orientation, and general operational health.

Astrobotic Peregrine Fueled & Ready for Lunar Mission

Fueled and integrated with ULA's Vulcan rocket, Peregrine is targeting launch on January 8, 2024

About 40 minutes after separation from ULA's Vulcan rocket, Peregrine's propulsion system will activate and begin receiving commands from Astrobotic's Mission Control Center. One of the first commands will initiate thrusters to point Peregrine's solar panels at the Sun to begin charging its battery. During cruise, the team will orchestrate trajectory adjustment maneuvers in Earth orbit before lunar orbit insertion. Peregrine will then dwell in a stable orbit and perform system checkouts before attempting a historic landing on February 23, 2024.



Photo Credit: United Launch Alliance

Astrobotic Peregrine Fueled & Ready for Lunar Mission

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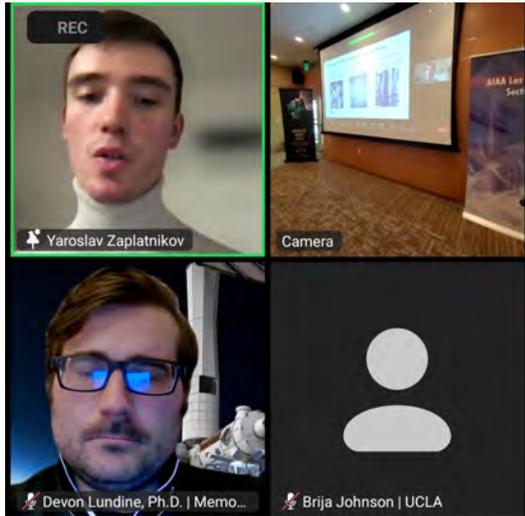
Photo Credit: United Launch Alliance

About Astrobotic

Astrobotic is the Moon company and more. We develop advanced navigation, operation, power, testing, and computing systems for spacecraft. Our fleet of lunar landers and rovers deliver payloads to the Moon for companies, governments, universities, non-profits, and individuals. To date, we have two fully funded lunar lander missions on the books, and more than 60 prior and ongoing NASA and commercial technology contracts worth upwards of \$450 million. Astrobotic was founded in 2007 and is headquartered in Pittsburgh, PA.
www.astrobotic.com

Commercialization of Space Biomedicine: How SpaceBox Accelerates Drug Screening in Microgravity (2023 December 9) *(Photos & Screenshots Only)*

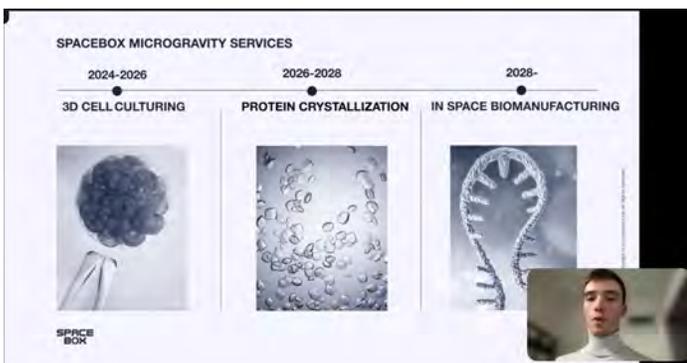
<https://www.aiaa-lalv.org/blogs/2023-blogs/2023-december/2023-december-9>



(Left) Mr. Yaroslav Zoplatnikov and Dr. Devon Lundine joined on-line, while (right) Ms. Alina Voronina presented in person.

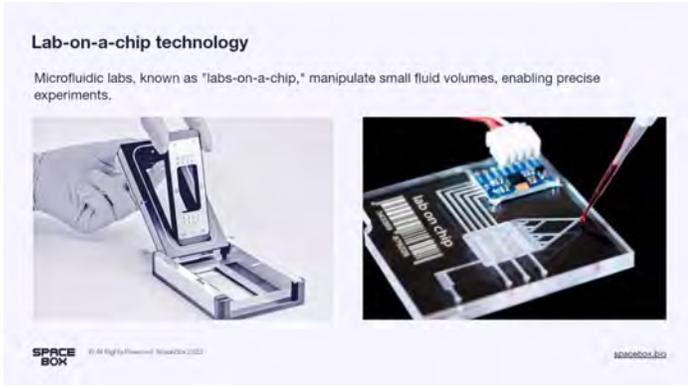


(Left) Check-in table for the attendees to sign in. (Right) Attendees in person and on-line listened to the presentation by Mr. Zaplatnikov.



(Left) Mr. Zaplatnikov introduced the SpaceBox Microgravity Services. (Right) Online and in-person participation.

Commercialization of Space Biomedicine: How SpaceBox Accelerates Drug Screening in Microgravity (2023 December 9) *(Photos & Screenshots Only)*



(Left) Mr. Zaplantnikov introduced the Lab-on-a-chip technology by SpaceBox. (Right) Attendees were following the presentation.

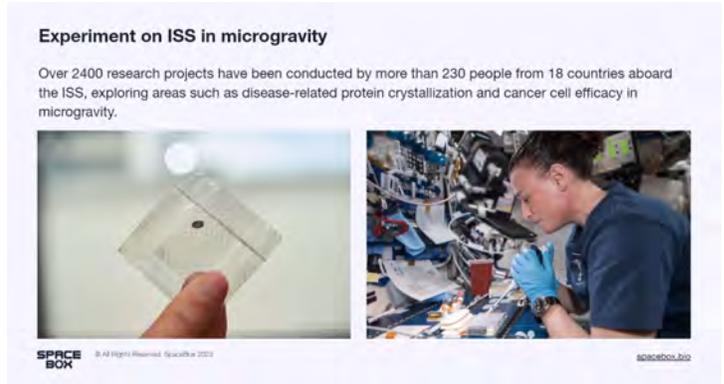
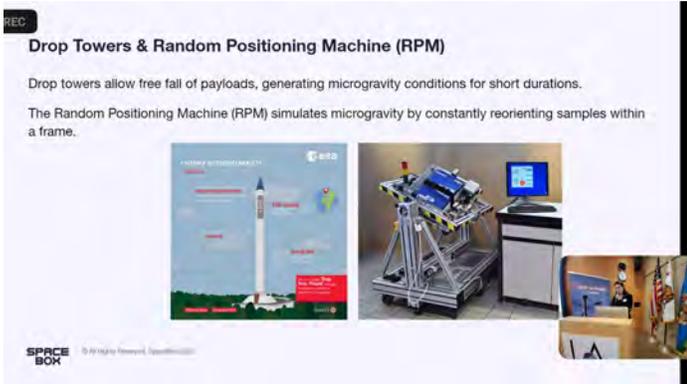


Online attendees asked questions, while Mr. Zaplantnikov explaining with more charts and details.



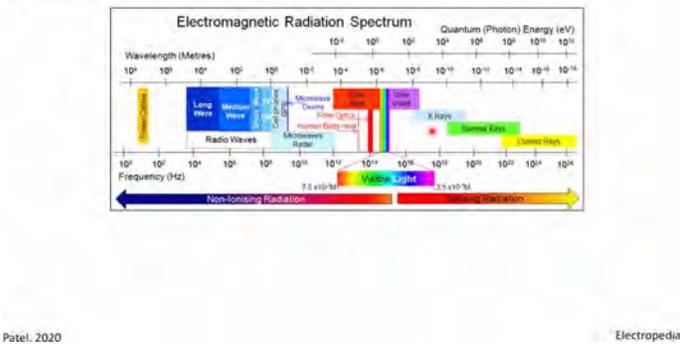
(Left) Ms. Alina Voronina (a local high school student) continued to present for SpaceBox. (Right) She also mentioned her career path.

Commercialization of Space Biomedicine: How SpaceBox Accelerates Drug Screening in Microgravity (2023 December 9) *(Photos & Screenshots Only)*



Ms. Alina Voronina introduced further the SpaceBox capabilities and experiments on ISS in microgravity.

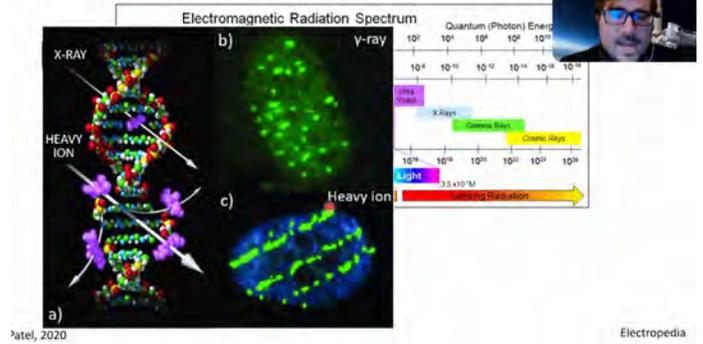
Cosmic Rays and You



Patel, 2020

Electropedia

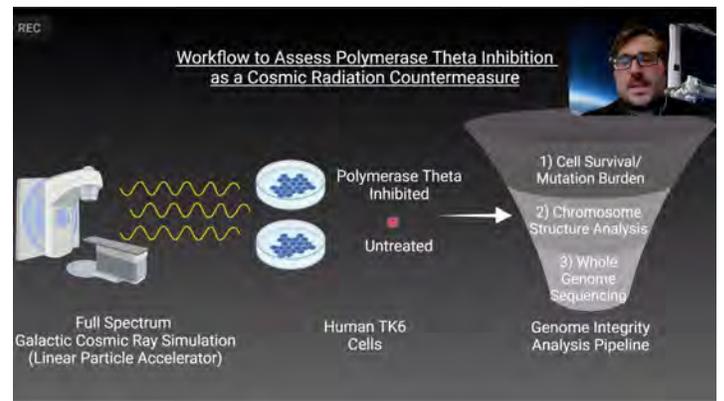
Cosmic Rays and You



Patel, 2020

Electropedia

Dr. Devon Lundine explained the cosmic rays and the damages to DNA by different types of radiations.



(Left) Research on Polymerase Theta and cancer & DNA mutation. (Right) Workflow to assess Polymerase Theta Inhibition to counter cosmic radiation damages.

Commercialization of Space Biomedicine: How SpaceBox Accelerates Drug Screening in Microgravity (2023 December 9) *(Photos & Screenshots Only)*

Our Team

Devon Lundine, Ph.D. Research Fellow | Daniel Higginson, M.D. Radiation Oncologist

Critical Assets

- Agreement with Columbia University Neutron Beam facility (Access to Simulated Cosmic Radiation)
- Agreement with KromaTID inc. (Chromosome Painting)
- Access to Memorial Sloan Kettering genomics and cytogenetics core facilities
- Target completion date: Summer 2024

Research funding from NIH, Sloan Kettering Institute, among others

Published experts in alternative end joining and DNA repair mechanisms

Extensive experience in Basic and Clinical research

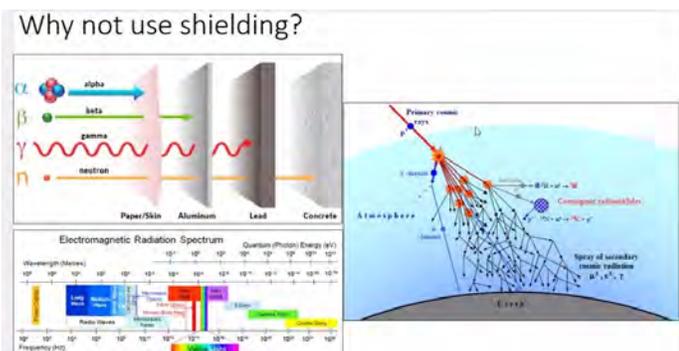
If you enjoyed this talk, check out...



(Left) Dr. Lundine's project in MSK Cancer Center. (Right) Attendees on-line / in-person interacted with Dr. Devon Lundine.



Dr. Lundine addressed the questions from Mr. Gary Moir, who managed to join in person during the Q&A Session.



(Left) Dr. Lundine talked about radiation shielding. (Right) Mr. Gary Moir was involved in the Vikings' Life on Mars instrumentation.

Commercialization of Space Biomedicine: How SpaceBox Accelerates Drug Screening in Microgravity (2023 December 9) *(Photos & Screenshots Only)*



Attendees were having fun and posed for photos.



Ms. Alina Voronina and the AIAA LA-LV Section Appreciation Certificate for her.

IMAGINE: Integrating Moon and Geo in Earth Orbit
USC Astronautics ASTE527 Fall 2023 Final Presentations
Viterbi School of Engineering
M. Thangavelu, Conductor

IMAGINE
 Integrating Moon and Geo in Earth Orbit

IMAGINE
 INTEGRATING MOON & GEO IN EARTH ORBIT
ASTE-527
 USC ASTRONAUTICS

M.Thangavelu, Conductor
 Tuesday, December 12th
 Department of Astronautical Engineering
 Viterbi School of Engineering
 University of Southern California

Introduction

Ideation marks the inception of creation, and ASTE527 Space Architecting Studio is a graduate course in the department of Astronautical Engineering within the USC Viterbi School of Engineering devoted to its exploration. This studio aims to unleash unbridled imagination and creativity, recognizing imagination as the bedrock of knowledge that propels progress in modern civilization.

Imagination, a unique faculty of our species, has positioned us as a dominant force of nature, ushering in the Anthropocene era. It serves as the ladder upon which we unlock the mysteries of the universe, sustaining our curiosity and driving us to seek new horizons in nature.

Exploration and Vision

The Astronautics studio is dedicated to the imaginative exploration of the future of human spaceflight. Discussions and debates within the studio cover a spectrum of ongoing projects, alternative options, and visionary concepts relevant to national priorities and those beyond domestic space efforts.

Government policies determine the trajectory of goals and project realization crucial to national interests. Cislunar space, the immediate physical domain reflecting US space policy and Free World Values, serves as the arena for various space science and technology projects, including human spaceflight missions. Notably, the Artemis Project and Artemis Accords embody this policy mandate.

Cislunar Strategy

While current attention is divided among three human spaceflight projects, a call is made to explore privatization options for the International Space Station (ISS) rather than its decommissioning. Emphasis is placed on focusing NASA's efforts on the Artemis and Artemis III touchdown, leveraging private space sector assets for cislunar transportation and logistics.

A proposed BuzzCraft Cislunar Cyler architecture, originating from previous studio discussions, envisions fully reusable modular propulsion systems delivered to Earth orbit, contributing to cislunar cyler operations. The vision includes on-orbit fueling capabilities and the LEADER lunar rover mission concept emphasizes the potential of ISS utilization for integrating and staging cislunar spacecraft.

Lunar Exploration and Beyond

Recommendations extend to lunar exploration, with a focus on the lunar Gateway providing valuable experience for evolving interplanetary transit vehicle architecture. The document explores recent advancements such as the Inflatable trans-atmospheric decelerator (LOFTID) and the potential for directed energy systems, like the proposed Eden Shield project, to enhance Planetary Defense.

Cislunar Communication

Cislunar communication emerges as a vital component, advocating for the deployment of advanced SpaceX StarLink satellites to establish a robust optical communications network. The SELENE project proposes unloading the oversubscribed Deep Space Network (DSN) burden onto more efficient optical networks.

Advanced Technologies and Sustainability

Advancements in laser technology, robotics, and co-robots are acknowledged, emphasizing their applications in various space-related endeavors. IMAGINE touches upon the potential use of high-energy lasers for planetary defense and implications for Earth observation and climate change mitigation.

Lunar Exploration and Global Collaboration

Exploration beyond low Earth orbit (LEO) is envisioned, promoting the idea that LEO is the ideal location for integrating large spacecraft and staging lunar missions. The potential of multinational collaboration and the positive impact of commercial space activities on global cooperation are highlighted.

Policy and Excellence

A shift in NASA priorities and the need for an Office for Commercial Human Spaceflight within the Department of Commerce are proposed. The importance of proactively expanding current partnerships and pursuing collaboration with Russia, China, and India in civilian human space activities is emphasized, drawing parallels with the historical Apollo-Soyuz collaboration.

Pursuit of Excellence

The document underscores the limitations of a competitive mindset and advocates for the pursuit of excellence in human spaceflight endeavors. A comparison is drawn with the Apollo project's firm policy and masterplan, highlighting the need for a clear mandate to shape the future of human space activity.

Shaping the Future

The transition from the Holocene to the Anthropocene era prompts considerations of sustainability in human activities. The document emphasizes the fragility of Earth and outer space environments, necessitating sensitive approaches to proposed human activities.

Artemis Project and Future Direction

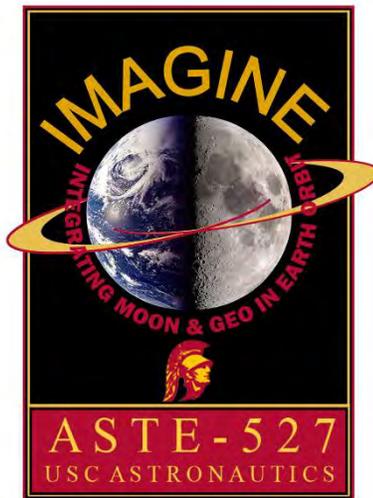
The Artemis Project, launched five decades after Apollo, symbolizes a new era of human exploration and long-term lunar activities. The Artemis Accords, though gaining global consensus slowly, offer an opportunity to extend optical communication links and attract more nations into the fold.

Evolving NASA Priorities

NASA's evolving priorities are acknowledged, with a shift towards the "NASA as customer" model, fostering innovation and creativity among commercial providers. The document proposes relieving NASA of International Space Station (ISS) operations and management, potentially shifting it to a world-class university, to allow NASA to focus on early lunar return.

Conclusion

In conclusion, the 2023 fall USC IMAGINE project envisions a future for human spaceflight that engages nations in cooperation and collaboration. At the core, human spaceflight allied technologies can offer clean energy, clean air and clean water for humanity on Earth, as it does today on the Space Station. USC IMAGINE serves as a glimpse into the hope and aspirations of a new generation of space architects, artists, scientists, engineers, and explorers participating in the ASTE527 Graduate Space Concept Synthesis Studio.



SPACEPOWER-Star Shield, Proven & Patented Peacemaker for Peace On Earth & Above! (2023 December 12)

(Screenshots only) (<https://www.aiaa-lalv.org/blogs/2023-blogs/2023-december/2023-december-12>)



The opening song, "Elvis Presley - If I Can Dream", was an integrated part of the presentation.

Space Force announces new mission statement
 Published Sept. 9, 2022, Secretary of the Air Force Public Affairs, Alexandria, Va. (AF/IS)

"Secure" refers to the Space Force's formative purpose to contest, and when directed, control the space domain on behalf of the nation and joint force. "Our Nation's interests" represents Guardians' focus on protecting the security and prosperity the U.S. derives from space. It also serves as a reminder that space activities are essential to the American way of life. "In, from, and to space" references the three core functions of the Space Force, which include securing the Nation's interests:

- 1. In space**, through space superiority activities that protect the joint force and nation from space and counterspace threats.
- 2. From space**, by delivering global mission operations like satellite communications, positioning, navigation and timing, and missile warning activities.
- 3. To space**, by assured space access through the service's launch, range and control network infrastructure.

❖ "Our mission statement is a call to action that concisely encapsulates our purpose and identity as Guardians and members of the profession of arms," Saltzman said.

Mr. Shawn Boike started the presentation with the new Mission Statement of the US Space Force (Happy Birthday for USSF!)

Low power beacon centered at the rectenna irradiates the Power Star

Simultaneously, each small patch antenna printed on the surface does the following:

- (1) Receives the beacon signal
- (2) Amplifies it,
- (3) Uses a simple analog circuit to conjugate the phase, and
- (4) Transmits the signal back in the direction from which it came

Power Star shares this technique with many other SSP concepts, and it is rock solid mathematically, physically and experimentally.

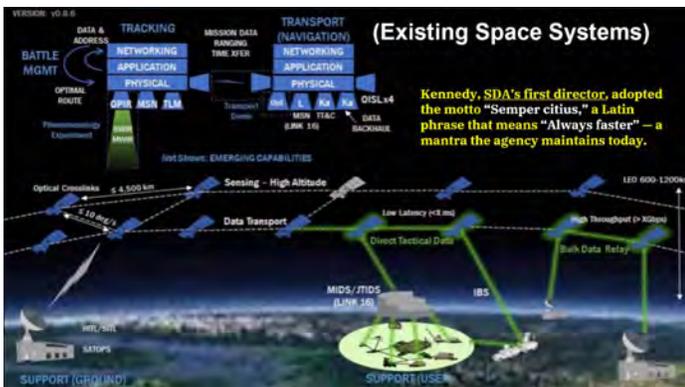
Spoiler Alert-brief only

At 36,000 km, power density = 1/10 sun
 Then: At 1000 km, power density = (36)² x 0.1Sun = **130 Suns**

Mr. Shawn Boike gave a quick overview of the technologies behind the Power-Star. More details will be elaborated by Prof. David Hyland.

SPACEPOWER-Star Shield, Proven & Patented Peacemaker for Peace On Earth & Above! (2023 December 12) (Screenshots Only)

A DoD study in 2006 indicated the 1 with the most energy wins, and we need to gain know-how to solve Starting Today!



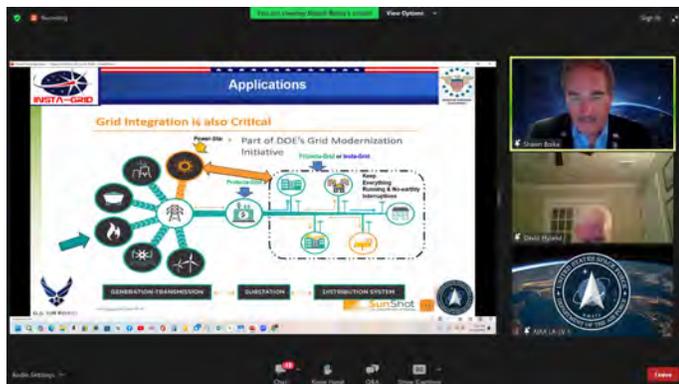
(Left) The existing Space Systems adopted the motto of "Always Faster." (Right) The Power Star used the known existing technologies.

(Left) The Power-Star can solve the issues of Solar Flares, EMP & Nukes. (Right) Insta-Grid's Power-Star proposal to harvest the solar energy.

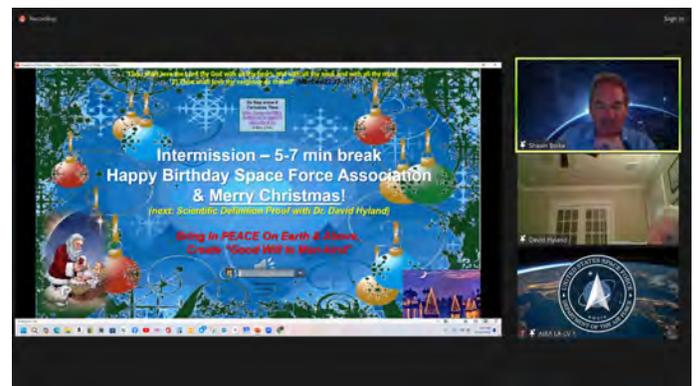
SPACEPOWER-Star Shield, Proven & Patented Peacemaker for Peace On Earth & Above! (2023 December 12) (Screenshots Only)



Mr. Shawn Boike talked about the possible Space Defense Scenario.

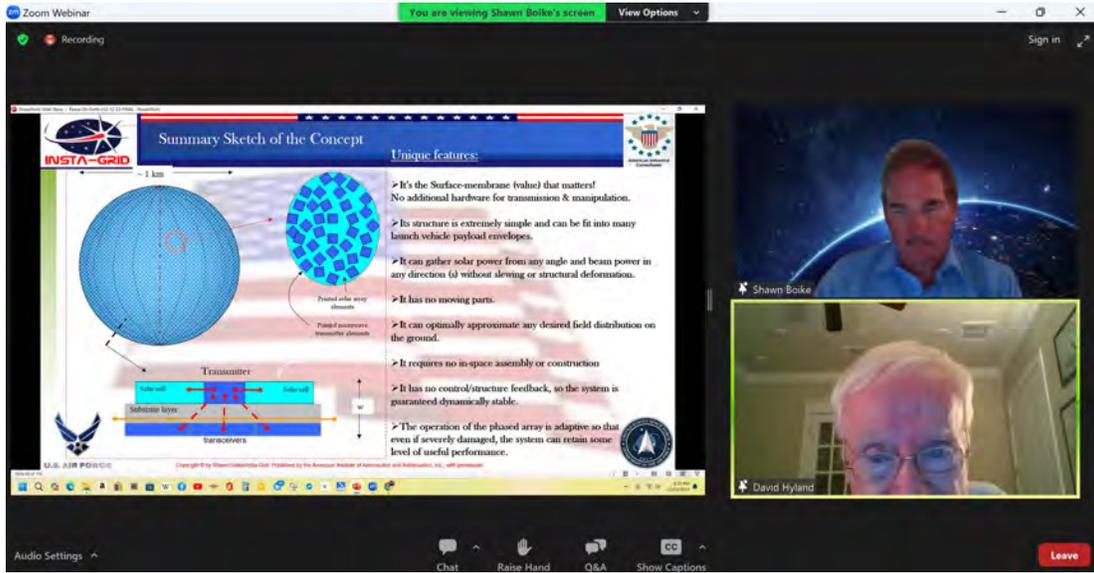


Mr. Shawn explained the applications and basics in Space Solar Power / Power-Star.

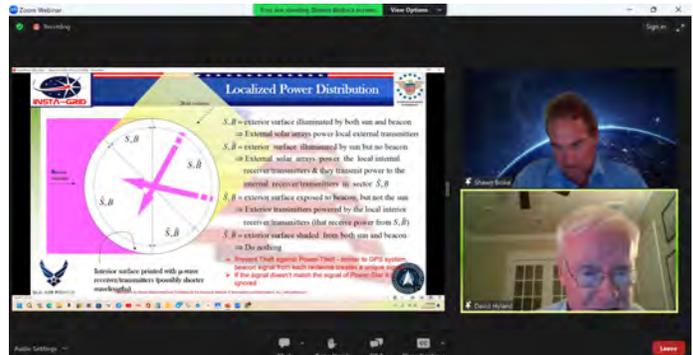
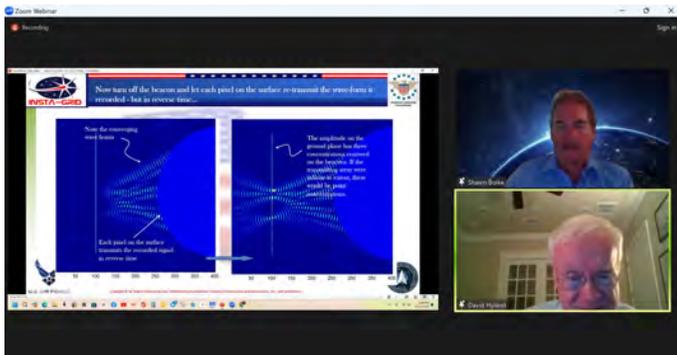


(Left) The song played during Intermission, "(Feed The World) Do they Know It's Christmas Time - Band Aid 1984," was also an integrated part of the presentation. (Right) Happy Birthday for Space Force Association, and Merry Christmas message for all during Intermission.

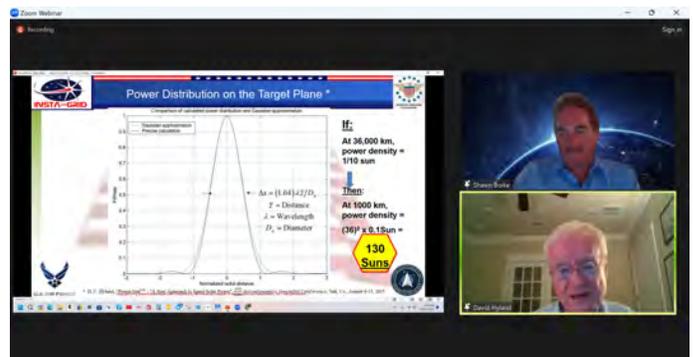
SPACEPOWER-Star Shield, Proven & Patented Peacemaker for Peace On Earth & Above! (2023 December 12) (Screenshots Only)



Prof. David Hyland talked about the summary sketch for the Concept of Power-Star, involving Space, EM, and nanotechnologies.

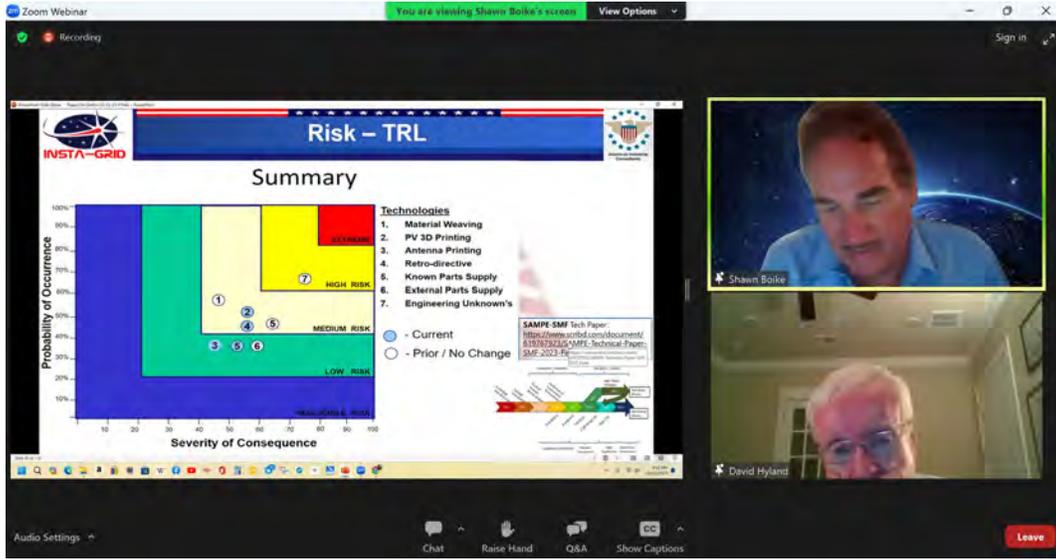


(Left) Interactions between the beacon signal and the beamed wave-form in reverse time. (Right) Localized Power Distributions, based on the illumination from the Sun and the beacon.

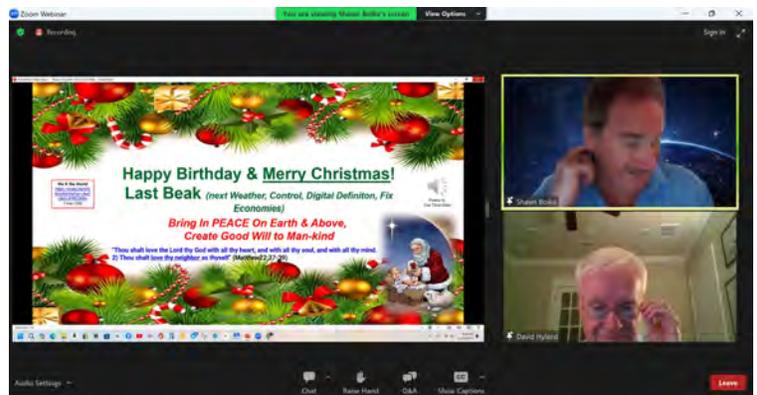


(Left) It's like the radar operation for the Power-Star Self Defense. (Right) Power Distribution on the Target Plane.

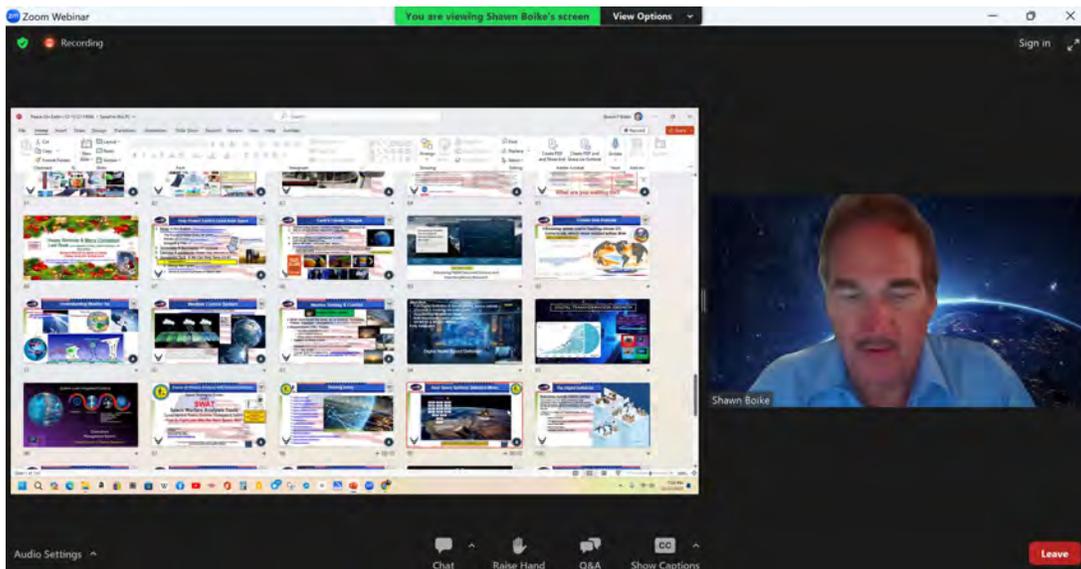
SPACEPOWER-Star Shield, Proven & Patented Peacemaker for Peace On Earth & Above! (2023 December 12) (Screenshots Only)



Summary of the presentation, including the Risk assessment and the TRL level for the Power-Star.



(Left) "U.S.A. For Africa - We Are the World", the ending song before the conclusion of this presentation. (Right) The Last Break before Conclusion.



Mr. Shawn Boike actually prepared much more slides for a Session 3, which will be in the next presentation after this one.

AIAA LA-LV Aero Alumni (retirees from aerospace) Meeting (2023 December 13)

(Screenshots only) (<https://www.aiaa-lalv.org/blogs/2023-blogs/2023-december/2023-december-13>)



Attendees got together in person and on-line, chatting from nuclear power, AI, Mike's Ciminera's Dec. 7 talk / books, and Startship etc.



Folks continued the discussions/conversations, after some had to leave the meeting early. Happy Holidays!

Safe Is Not An Option: Overcoming The Futile Obsession With Getting Everyone Back Alive That Is Killing Our Expansion Into Space (2023 December 16)

(Photos, Screenshots Only) (<https://www.aiaa-lalv.org/blogs/2023-blogs/2023-december/2023-december-16>)



Mr. Rand Simberg prepared many interesting slides with additional notes. It's an interesting topic and presentation.



(Left) Mr. Rand Simberg discussed NASA's roles in Human Space Explorations. (Right) An in-person attendee asked very interesting questions.



(Left) Ms. Joan Horvath listened to the talk with great attention. (Right) An attendee asked about the Space Medicine and Safety issues.

Safe Is Not An Option: Overcoming The Futile Obsession With Getting Everyone Back Alive That Is Killing Our Expansion Into Space (2023 December 16)



Every time with a new way of transportation, it was always deemed very dangerous, including the early days of aviation.

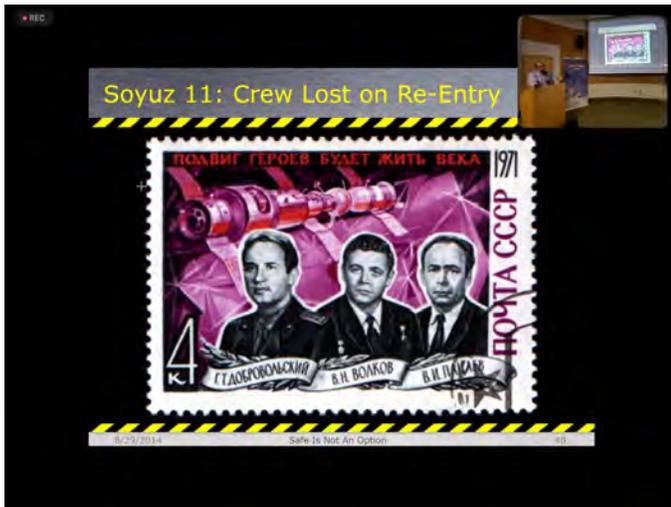


The Rise of Naval Aviation and the case of Apollo 13 were very good case studies.



The tragedies of the 1986 Space Shuttle Challenger, and the 2003 Space Shuttle Columbia, were sad examples of the sacrifices / losses.

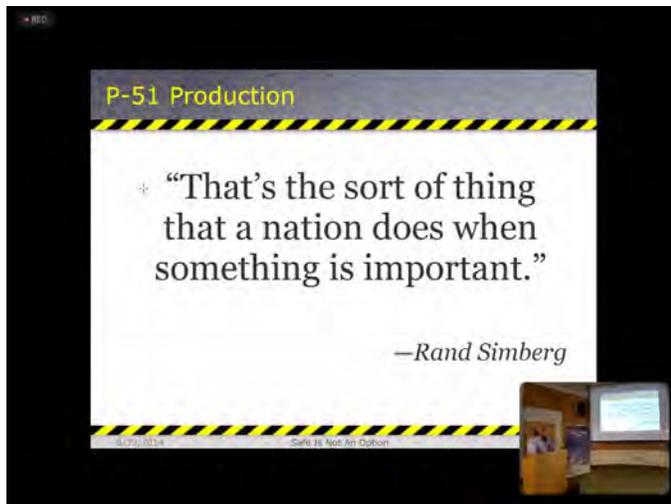
Safe Is Not An Option: Overcoming The Futile Obsession With Getting Everyone Back Alive That Is Killing Our Expansion Into Space (2023 December 16)



(Left) The former Soviet Union experienced painful losses as well. (Right) Some compared the Space Program to the Antarctica Mission.



(Left) Long time to return to flight after the 2 Space Shuttle tragedies. (Right) The P-51 program was an example for very important projects.



(Left) The United States did it before for important things. (Right) Discussions for the Value of a Human Life in Space Programs.

Safe Is Not An Option: Overcoming The Futile Obsession With Getting Everyone Back Alive That Is Killing Our Expansion Into Space (2023 December 16)

	Armadillo	Blue Origin	Sierra Nevada	SpaceX	Strato-launch	Virgin Galactic	XCOR
Vehicle	Various	Various	Dream Chaser	Falcon 9 / Dragon	TBD	SpaceShip Two	Lynx
Suborbital	Yes	Yes	No	No	No	Yes	Yes
Orbital	No	Maybe	Yes	Yes	Yes	No	No
Passengers	Yes	Yes	Yes	Yes	TBD	Yes	Yes
Takeoff Mode	Vertical	Vertical	Vertical	Vertical	Horizontal	Horizontal	Horizontal
Landing Mode	Vertical	Vertical	Horizontal	Vertical	TBD	Horizontal	Horizontal
Air Launched	No	No	No	No	Yes	Yes	No
Expendable	No	No	Yes	TBD	TBD	No	No
Reusable	Yes	Yes	Partially	TBD	Partially	Yes	Yes
Initial Operations	Spaceport America	Van Horn, Texas	Cape Canaveral	Cape Canaveral	Mojave CA	Mojave CA	Mojave CA / Midland TX
Eventual Operations	TBD	TBD	KSC	KSC + Texas?	KSC + TBD	Spaceport America	Curaçao, KSC, others

8/29/2014 Safe Is Not An Option 95

A very nice chart for Commercial Space Development, to be updated to the current status.

Commercial Spaceflight Federation

Preparing for a Bad Day in the industry:

- Standardized “informed consent” language
- Calculating risk with small sample sets
- Disaster simulation session with NTSB

“It’s not a matter of ‘if’— it’s a matter of ‘when.’”

8/29/2014 Safe Is Not An Option

What is the Government's Role?

“You have to go out, but you don't have to come back.”

8/29/2014 Safe Is Not An Option

(Left) Preparation for a Bad Day, and (Right) The Government's Role in the human safety.

AIAA Statement on Design/Build/Launch Student Experiments Onboard Successful Blue Origin New Shepard Mission *(Written 19 December 2023)*

<https://www.aiaa.org/news/news/2023/12/19/aiaa-statement-on-design-build-launch-student-experiments-onboard-successful-blue-origin-new-shepard-mission>

December 19, 2023 – Reston, Va. – The American Institute of Aeronautics and Astronautics (AIAA) issued the following statement from AIAA CEO Dan Dumbacher:

“Congratulations to the Blue Origin team on today’s successful return to flight for their New Shepard rocket. AIAA recognizes the countless industry professionals who support New Shepard. We applaud AIAA Corporate Member Blue Origin for its perseverance in addressing the findings from the NS-23 mission mishap to achieve this successful mission today.



Pictured: Blue Origin's New Shepard rocket launches from its spaceport near Van Horn, Texas, Tuesday, 19 December 2023. | Credit: Blue Origin; video framegrab

We are thrilled that two AIAA-sponsored student experiments were conducted during today’s New Shepard flight. The two experiments are winners of the [Design/Build/Launch \(DBL\) competition](#) sponsored by AIAA and Blue Origin:

- **Improving Fluid Management Through A Novel Microgravity Slosh Mitigation Technique by Eleanor Sigrest**, graduate and valedictorian of a dual program at Forest Park High School in Woodbridge, Virginia, and the Governor’s School at Innovation Park, Manassas, Virginia
- **Acoustic Levitation Under Variable G by Puneeth Bheesetty, Anna Porter Puckett, and Jaden Shawyer**, graduates of Granby High School, Norfolk, Virginia

The DBL program is targeted to high school students, giving them an opportunity to develop creative research proposals for experimental payloads designed to study short-duration microgravity effects. The winners received \$1,000 grants to prepare their work for flight onboard New Shepard.

We are excited to witness these students conducting their microgravity experiments and we can’t wait to hear more about their results. Their enthusiasm and passion inspire us as we anticipate their remarkable career journeys toward shaping the future of aerospace.”

About AIAA

The American Institute of Aeronautics and Astronautics (AIAA) is the world’s largest aerospace technical society. With nearly 30,000 individual members from 91 countries, and 100 corporate members, AIAA brings together industry, academia, and government to advance engineering and science in aviation, space, and defense. For more information, visit www.aiaa.org, or follow AIAA on [Twitter](#), [Facebook](#), or [LinkedIn](#).

Video

Blue Origin New Shepard Mission Launch 19 Dec. 2023 (YouTube)

<https://www.youtube.com/watch?v=RmQ5DWpdJWM>



AIAA National 2023 Winter - Spring Course Catalog Released

Build Skills with Online Courses

The Institute is offering many online short courses to help you stay sharp and improve your knowledge base. These courses are taught by renowned industry leaders and experts. Special pricing is available for AIAA members and student members, as well as group discounts for five or more individuals from the same organization. Enroll in an upcoming course.

BROWSE CATALOG

UPCOMING COURSES



Aircraft Maintenance Management – Online Short Course (Starts January 16, 2024)
[View Details](#) | [Buy Now](#)



Mission-based Vehicle Design: Digital Mission Engineering for Advanced Air Mobility (Online Short Course – Starts Jan 29, 2024) [View Details](#) | [Buy Now](#)



Cryogenic Fluid Management for Storage & Transfer of Liquid Propellants in Space – Online Short Course (Starts Jan 30, 2024)
[View Details](#) | [Buy Now](#)

AIAA National 2023 Winter - Spring Course Catalog Released



Vibration of Periodic Structures – Online Short Course (Starts Feb 6, 2024)
[View Details](#) | [Buy Now](#)



Fundamentals of Aeroelasticity: From Basics to Application – Online Short Course (Starts February 13, 2024) [View Details](#) | [Buy Now](#)



Principles of Success in Spaceflight from Andrew Chaikin – Online Short Course (February 21-22, 2024)



Design of Space Launch Vehicles – Online Short Course (Starts February 26, 2024)



Financial and Business Acumen for Navigating the Aerospace Industry – Online Short Course (Starts March 5, 2024)



New!
Turbomachinery for Emerging Space Applications: Liquid Rocket Propulsion – Online Short Course (Starts March 11, 2024)



New!
Aircraft Reliability & Reliability Centered Maintenance – Online Short Course (Starts March 19, 2024)



New!
Design Evolution of Aircraft Structures – Online Course (Starts March 19, 2024)



New!
Test Foundations for Flight Test – Online Short Course (Starts April 8, 2024)



Human Spaceflight Operations: Lessons Learned from 60 Years in Space – Online Short Course (Starts May 7, 2024)

AIAA National 2023 Winter - Spring Course Catalog Released



Guidance and Control of Hypersonic Vehicles - Online Short Course (Starts May 14, 2024)



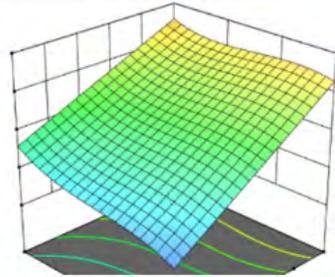
Spacecraft Lithium-Ion Battery Power Systems - Online Short Course (Starts May 21, 2024)



Safety Management System (SMS) in Aviation - Online Short Course (Sept 10 - 13, 2024)



Understanding Aircraft Noise: From Fundamentals to Design Impacts and Simulations - On-Demand Short Course



Design of Experiments: Improved Experimental Methods in Aerospace Testing - On-Demand Short Course



Launch Vehicle Coupled Loads Analysis: Theory and Approaches - On-Demand Short Course



Design of Space Launch Vehicles - On-Demand Short Course



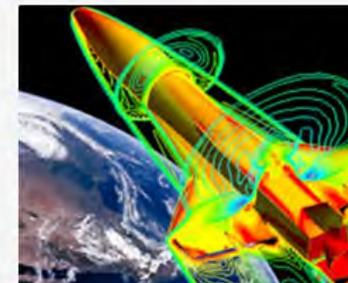
Space Architecture: Designing a Lunar Habitation System - On-Demand Short Course



Hypersonic Flight Vehicle Design and Performance Analysis - On-Demand Short Course



Hypersonics: Test and Evaluation - On-Demand Short Course



Hypersonic Applications: Physical Models for Interdisciplinary Simulation - On-Demand Short Course



Hypersonic Propulsion Concepts: Design, Control, Operation, and Testing - On-Demand Short Course

AIAA National 2023 Winter - Spring Course Catalog Released



Hypersonic Air-Breathing Propulsion - On-Demand Short Course



Fundamentals and Applications of Pressure Gain Combustion - On-Demand Short Course



Overview of Python for Engineering Programming - On-Demand Short Course



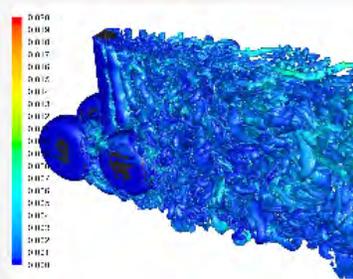
Turbomachinery for Emerging Space Applications: Liquid Rocket Propulsion - On-Demand Short Course



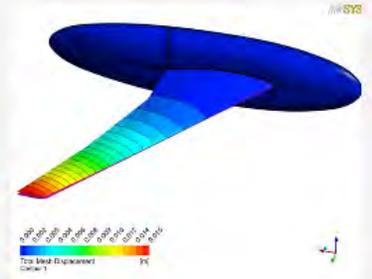
Liquid Rocket Engines: Emerging Technologies in Liquid Propulsion - On-Demand Short Course



Rocket Testing - On-Demand Workshop



Turbulence Modeling for Aerodynamic Flows - On-Demand Short Course



Higher Fidelity Designs for the Aerospace Industry with Fluid-Thermal Structural Interaction (FTSI) - On-Demand Short Course



Computational Aeroelasticity - On-Demand Short Course



Trusted Artificial Intelligence - On-Demand Short Course



AI for Air Traffic Safety Enhancement - On-Demand Short Course

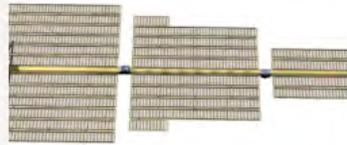


Machine Learning for Quantifying Uncertainties in Engineering Applications - On-Demand Short Course

AIAA National 2023 Winter - Spring Course Catalog Released



Fundamentals of Space Systems - On-Demand Short Course



Advanced Space Propulsion - On-Demand Short Course



Fundamentals of Thermal Vacuum Testing Science - On-Demand Short Course



Applications of Thermal Vacuum Testing - On-Demand Short Course



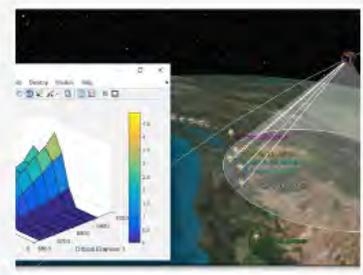
Introduction to Propellant Gauging - On-Demand Short Course



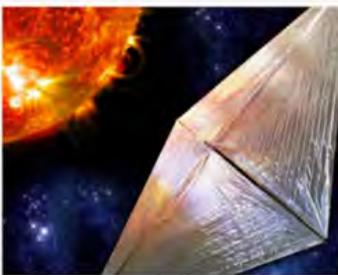
Satellite and SmallSat Thermal Control Engineering - On-Demand Short Course



Fundamentals of Space Vehicle Guidance, Control, and Astrodynamics - On-Demand Short Course



Designing Better CubeSats Using System-Level Simulations - On-Demand Short Course



Fundamentals of Classical Astrodynamics and Applications - On-Demand Short Course



Spacecraft Design, Development, and Operations - On-Demand Short Course



Fundamentals of Airplane Performance, Stability, Dynamics and Control - On-Demand Short Course



Flight Vehicle Guidance Navigation and Control Systems (GNC): Analysis and Design - On-Demand Short Course

Welcome ! New AIAA Members! (LA-LV Section)



- | | |
|-------------------|------------------|
| Patrick | Carlson |
| Alex | Jordan |
| Ms Sabrina | Ali |
| Jieva | Autri |
| Lily | Castro |
| Henry | MacMorran |
| Maria | Chamieh |
| Patrick | Hayes |
| Anne | Wen |
| Neela | Sneed |
| Ms Carrie | Lai |
| Isaiah | Suso |

***Welcome, new members!
And, Congratulations!***

AIAA LA-LV Aerospace News Digests (by Dr. Ken Lui, AIAA LA-LV Section)



(Dec. 12) Westinghouse, Northrop Grumman, and Astrobotic Awarded U.S. Air Force Contract to Power Satellites with Nuclear Energy



(Dec. 20) AIR ONE eVTOL moves forward with US Air Force AFWERX program



(Dec. 18) GE Aerospace tests groundbreaking jet engine, DMRJ: An innovation to propel hypersonic vehicles at 4,000 mph



(Dec. 11) Stratolaunch's Roc set to launch Talon-A on first hypersonic flight



(Dec. 19) New aerospace company investing in Stennis Airport operations. What to know



(Dec.19) Clark County reaches milestone in planning for new airport — but there's still a long way to go



(Dec. 14) Viewpoint: The legacy of Eisenhower's Atoms for Peace speech



(Dec. 13) Government Promotion of Safety and Innovation in the New Space Economy



(Dec. 17) North Korea Fires Ballistic Missile Into the Sea as South Korea, U.S. Step Up Deterrence Plans



(Dec. 20) House Subcommittee Considers Space Mining



(Dec. 14) NASA Study Finds Life-Sparking Energy Source and Molecule at Enceladus



(Dec. 19) North Korea's Kim threatens 'more offensive actions' against US after watching powerful missile test



(Dec. 20) New Annual Launch Record Set by Rocket Lab



(Dec. 15) First Images Of Spaceship Neptune's Capsule Structure



(Dec. 5) Richard Branson Is Cutting Off Virgin Galactic



(Dec. 10) This Week @NASA: The First Images From the Psyche Spacecraft & Space Station Milestone



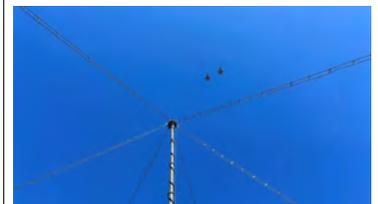
(Nov. 30) Anduril Builds a Tiny, Reusable Fighter Jet That Blows Up Drones



(Dec. 3) U.S. develops a new doomsday plane



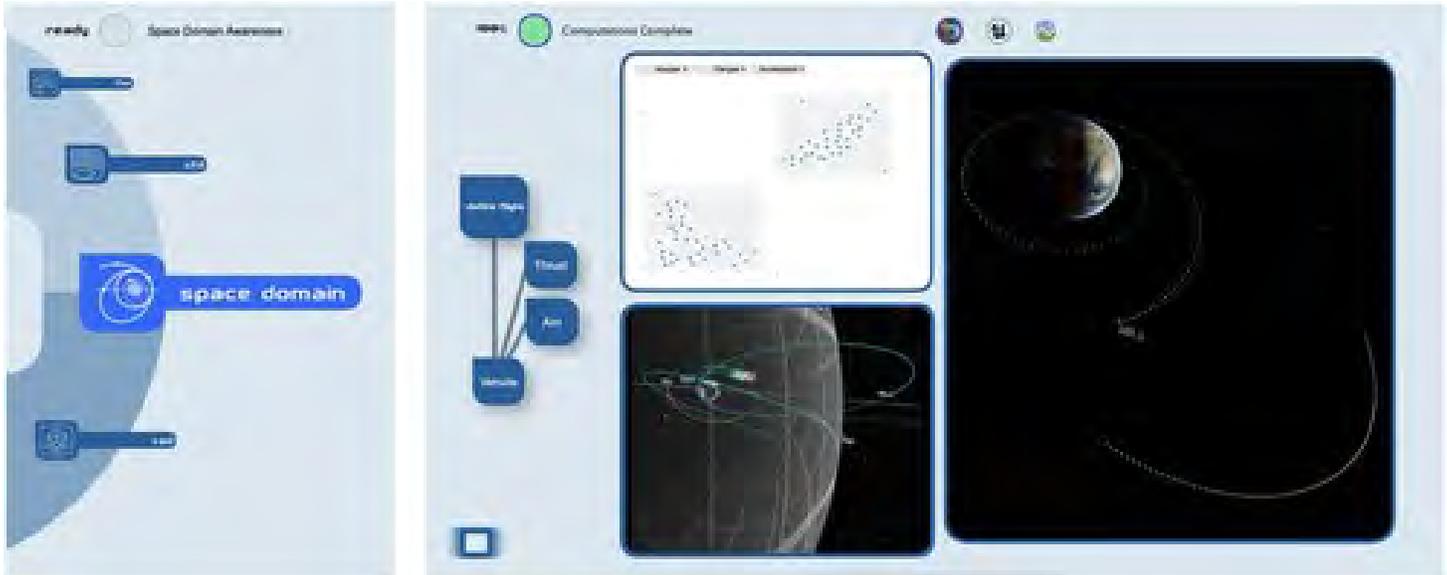
(Dec. 3) 'Robot' Invents Way To Make Oxygen On Mars That Would Take A Human 2,000 Years



(Nov. 27) Leidos awarded \$32M defense radar contract

Space Force selects GURU and Princeton to Build the Future of Immersive Collaborative Training for Space Flight Operations *(PR Newswire, 2023 Dec. 18, with permission)*

(<https://www.prnewswire.com/news-releases/space-force-selects-guru-and-princeton-to-build-the-future-of-immersive-collaborative-training-for-space-flight-operations-302017498.html>)



GURU driving a White Cell Training Scenario Generation Workflow Video, Introduction to GURU: <https://youtu.be/84VPjXCUYzE>

LOS ANGELES, Dec. 18, 2023 /PRNewswire/ -- MSBAI, an Air Force Techstars 2020 company, and partner Princeton University, have been awarded a 1.25 million dollar Phase 2 contract from SpaceWERX, in the Small Business Technology Transfer (STTR) X22.D cycle to bring the game-changing advantage of GURU, an Autonomous system that Drives expert workflows in Software, to space flight mission training scenario generation and visualization. GURU will bring autonomy to simulation and visualization workloads to meet demand coming from the worldwide radical increase in space missions.

U.S. Army General James H. Dickinson, Commander of U.S. Space Command, made the importance of training space flight mission operators clear when he said "U.S. Space Force, the Space Development Agency, and other key stakeholders must lead DoD efforts to build comprehensive military space power through a trained, equipped, and ready force that is integrated into Joint Force plans to support the Department's objectives to compete, deter, and win across the spectrum of conflict."

MSBAI and Princeton will work closely with the Air Force Research Laboratory Space Vehicles Directorate's (AFRL RV) Defense Readiness Agile Gaming Online Network (DRAGON) to hyper-enable their White Cell Trainer group to set up comprehensive mission design, analysis, and training scenarios in minutes (work that typically takes hours, and sometimes days, to accomplish).

The volume of both commercial and government space missions is growing exponentially, and teaching trainers with varying amounts of experience to create effective space flight mission operations training scenarios is a challenging task that requires careful planning and adaptation. This can lead to inconsistencies, gaps, and inefficiencies in the training process. To solve this MSBAI and Princeton will adapt GURU to solve the following problems:

- Creating compelling training scenarios is laborious and time-consuming
- It's easy to make mistakes and not catch them soon enough without comprehensive visualization
- Trainers need to increase the rate of training iterations, and rehearsal

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GURU will hyper-enable the user to easily create training scenarios, create comprehensive visualizations, and replay past training scenarios for analysis. To seize this opportunity, the high barriers to entry must be completely solved. Doing so will drive commercial collaboration, innovation, and rapid deployment of new technologies. The outcome of this effort will:

- Provide a user-friendly intuitive system with multiple visualization options for space operations
- Integrate with AFRL's White Cell Console to autonomously drive the simulation tools
- Create comprehensive visualizations of training scenarios (2D & 3D)
- Build and manage a library to store and replay simulations for later analysis

MSBAI trains comprehensive skills agents that autonomously drive expert workflows in an increasing number of software titles. This effort requires the integration of a variety of simulation software packages critical to space flight, including open source and commercial software like GMAT and Cesium. GURU will autonomously drive simulation setup and execution, making extensive use of DoD High Performance Computing Modernization Program (HPCMP) resources, and particularly supercomputers at AFRL DSRC. Immersive virtual world building will play an important role to maximize team understanding and collaboration through collaborative visualization, and GURU will autonomously drive software such as Unreal Engine for this purpose, ultimately supporting spatial computing and mixed reality experiences using the latest devices such as Apple's Vision Pro, Meta's Quest 3 and Ray-Ban Wayfarer.

Princeton University's Professor Ryne Beeson of Mechanical and Aerospace Engineering, brings his expertise in the mathematical theory of differential games (DG) and space flight mission design and analysis, providing guidance on data and scenario creation for studies in relevant differential games. His team will conduct research on the formulation of representative differential games for current space domain awareness (SDA) and courses of action (CoA) in Earth bound and cislunar environments.

Allan Grosvenor, MSBAI CEO, said

"Our team could not be more proud to be part of the future of space operations by hyper-enabling trainers analysts and operators to have a fast onramp to the best mission design and analysis tools, and to use them quickly and collaboratively."

This effort is consistent with a wider global trend in the scale up of immersive virtual world training, with a market size expected to reach one Trillion dollars. The commercialization opportunity from just the Unreal Engine component of this work addresses several million worldwide users, and commercial space demands this level of autonomy as space flight operations become as routine as commercial airline traffic.

About AFRL

The Air Force Research Laboratory (AFRL) is the primary scientific research and development center for the Department of the Air Force and United States Space Force. AFRL plays an integral role in leading the discovery, development, and integration of affordable warfighting technologies for our air, space, and cyberspace force. With a workforce of more than 11,000 across nine technology areas and 40 other operations across the globe, AFRL provides a diverse portfolio of science and technology ranging from fundamental to advanced research and technology development. For more information, visit: www.afresearchlab.com.

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About SpaceWERX

SpaceWERX is the Space component of AFWERX (a program office at the Air Force Research Laboratory-AFRL) which connects innovators across government, industry and academia. Through innovation and collaboration with our nation's top subject-matter experts and harnessing the power of ingenuity of internal talent, by expanding technology, talent, and transition partnerships for rapid and affordable commercial and military capability. Additional information is available at: <https://www.spacewerx.us/>.

References

Senate Armed Services Committee Advance Policy Questions for U.S. Army General James H. Dickinson is the Commander, U.S. Space Command

https://www.armed-services.senate.gov/imo/media/doc/Dickinson_APQs_07-28-20.pdf

1 Trillion Dollar Virtual Immersive Training Market Size

<https://www.verifiedmarketresearch.com/product/virtual-training-and-simulation-market/>

<https://www.zionmarketresearch.com/report/virtual-training-and-simulation-market>

MSBAI (dba for Microsurgeonbot Inc.) develops GURU <http://msb.ai> Allan@msb.ai

Princeton's Prof. Ryne Beeson <https://mae.princeton.edu/about-mae/spotlight/ryne-beeson-optimizing-spaceflight>

SOURCE MSBAI