

Newsletter

AIAA Los Angeles-Las Vegas Section

El Segundo, CA



JULY 20, 2021

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WITH BLUE ORIGIN'S NEW SHEPARD**



JULY 11, 2021

**RICHARD BRANSON IN SPACE
WITH VIRGIN GALACTIC
SPACESHIPTWO UNITY 22**

JULY!

JULY 20, 1976

VIKING 1 LANDING ON MARS



JULY 20, 1969

APOLLO 11 LANDING ON THE MOON





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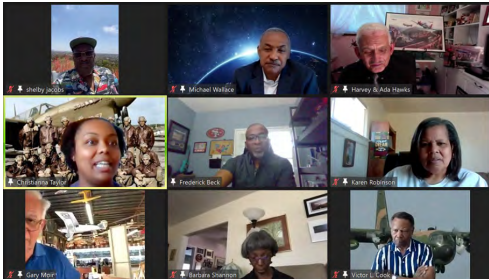
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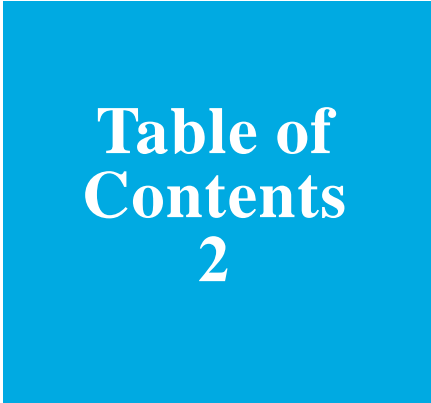
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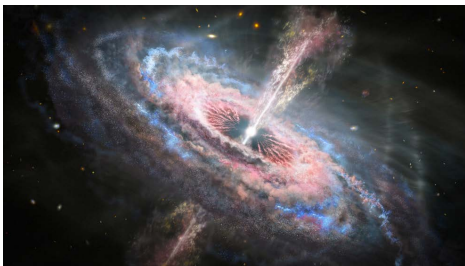
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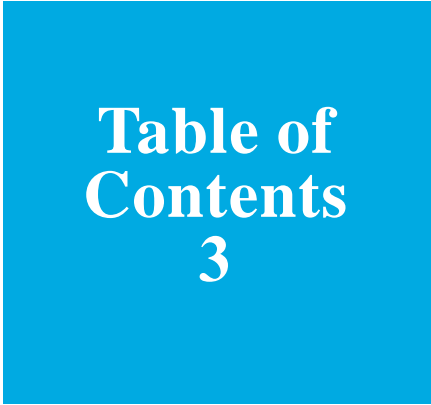
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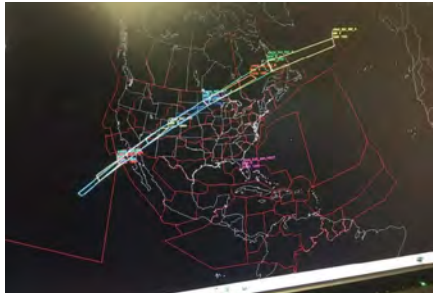
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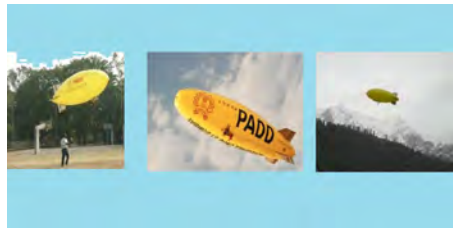
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Virgin Galactic Successfully Completes First Fully Crewed Spaceflight

Fourth Spaceflight Tests Private Astronaut and Research Experience

First In-Flight Livestream Brings Spaceflight Experience to Audiences Around the World

Unity 22 "hero" video here: <https://f.io/17Si0g5B>

LAS CRUCES, N.M. July 11, 2021 – Virgin Galactic Holdings, Inc. (NYSE: SPCE) (“the Company” or “Virgin Galactic”) today announced that VSS Unity successfully reached space, completing the Company’s fourth rocket-powered spaceflight.

Today’s flight was the 22nd test flight of VSS Unity and the first test flight with a full crew in the cabin, including the Company’s founder, Sir Richard Branson. The crew fulfilled a number of test objectives related to the cabin and customer experience, including evaluating the commercial customer cabin, the views of Earth from space, the conditions for conducting research and the effectiveness of the five-day pre-flight training program at Spaceport America.

Michael Colglazier, Chief Executive Officer of Virgin Galactic, said: “Today is a landmark achievement for the Company and a historic moment for the new commercial space industry. With each successful mission we are paving the way for the next generation of astronauts. I want to thank our talented team, including our pilots and crew, whose dedication and commitment made today possible. They are helping open the door for greater access to space – so it can be for the many and not just for the few.”

VSS Unity achieved a speed of Mach 3 after being released from the mothership, VMS Eve. The vehicle reached space, at an altitude of 53.5 miles, before gliding smoothly to a runway landing at Spaceport America.

This seminal moment for Virgin Galactic and Sir Richard Branson was witnessed by audiences around the world. It gave a glimpse of the journey Virgin Galactic’s Future Astronauts can expect when the Company launches commercial service following the completion of its test flight program. A recording of the livestream can be accessed on Virgin Galactic’s [YouTube channel](#).

Sir Richard Branson said: “I have dreamt about this moment since I was a child, but nothing could have prepared me for the view of Earth from space. We are at the vanguard of a new space age. As Virgin’s founder, I was honoured to test the incredible customer experience as part of this remarkable crew of mission specialists and now astronauts. I can’t wait to share this experience with aspiring astronauts around the world.”

Branson continued, “Our mission is to make space more accessible to all. In that spirit, and with today’s successful flight of VSS Unity, I’m thrilled to announce a partnership with Omaze and Space for Humanity to inspire the next generation of dreamers. For so long, we have looked back in wonder at the space pioneers of yesterday. Now, I want the astronauts of tomorrow to look forward and make their own dreams come true.”

The mission specialists in the cabin were Beth Moses, Chief Astronaut Instructor; Colin Bennett, Lead Flight Operations Engineer; Sirisha Bandla, Vice President of Government Affairs and Research Operations; and the Company’s founder, Sir Richard Branson. The VSS Unity pilots were Dave Mackay and Michael Masucci, while Kelly Latimer and CJ Sturckow piloted VMS Eve.



Sirisha Bandla in space



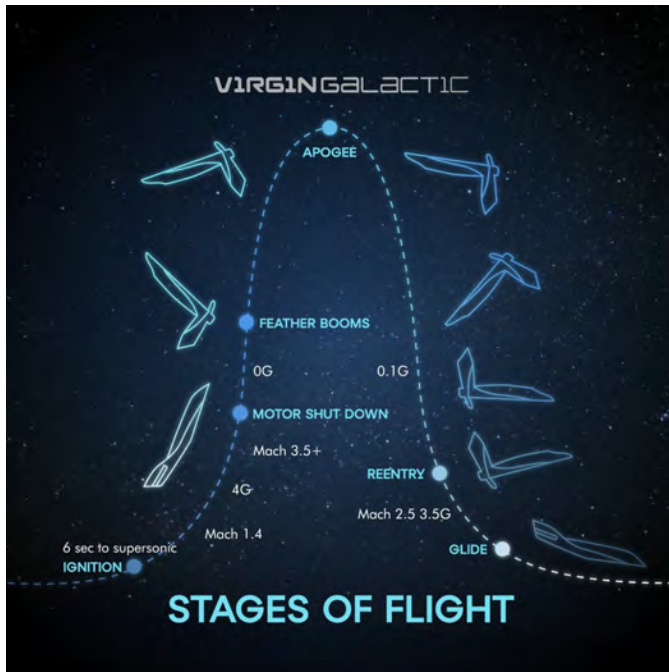
Richard Branson in space #Unity22



VSS Unity in space during #Unity22 test flight



VSS Unity tailcone view from space #Unity22



(Left to Right) Pilot Dave Mackay; Coplin Bennet, lead operations engineer; Beth Moses, chief astronaut instructor; Branson; Sirisha Bandla, vice president of government affairs and research operations; and pilot Michael Masucci.

Advertising space is available in the AIAA Los Angeles-Las Vegas Newsletter:

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Blue Origin safely launches four commercial astronauts to space and back

by Gradatim Ferociter, Blue Origin

July 20, 2021—Blue Origin successfully completed New Shepard's first human flight today with four private citizens onboard. The crew included Jeff Bezos, Mark Bezos, Wally Funk and Oliver Daemen, who all officially became astronauts when they passed the Kármán Line, the internationally recognized boundary of space.

Upon landing, the astronauts were greeted by their families and Blue Origin's ground operations team for a celebration in the West Texas desert.

A Historic Mission

- Wally Funk, 82, became the oldest person to fly in space.
- Oliver Daemen, 18, was the first ever commercial astronaut to purchase a ticket and fly to space on a privately-funded and licensed space vehicle from a private launch site. He also became the youngest person to fly in space.
- New Shepard became the first commercial vehicle under a suborbital reusable launch vehicle license to fly paying customers, both payloads and astronauts, to space and back.
- Jeff and Mark Bezos became the first siblings to ever fly in space together.

"Today was a monumental day for Blue Origin and human spaceflight," said Bob Smith, CEO, Blue Origin. "I am so incredibly proud of Team Blue, their professionalism, and expertise in executing today's flight. This was a big step forward for us and is only the beginning."

Blue Origin expects to fly two more crewed flights this year, with many more crewed flights planned for 2022.

If you'd like to purchase a commemorative patch from today's mission, head to the [Blue Origin Shop](#).

You can also watch a full replay of today's flight and the post-flight press conference below.

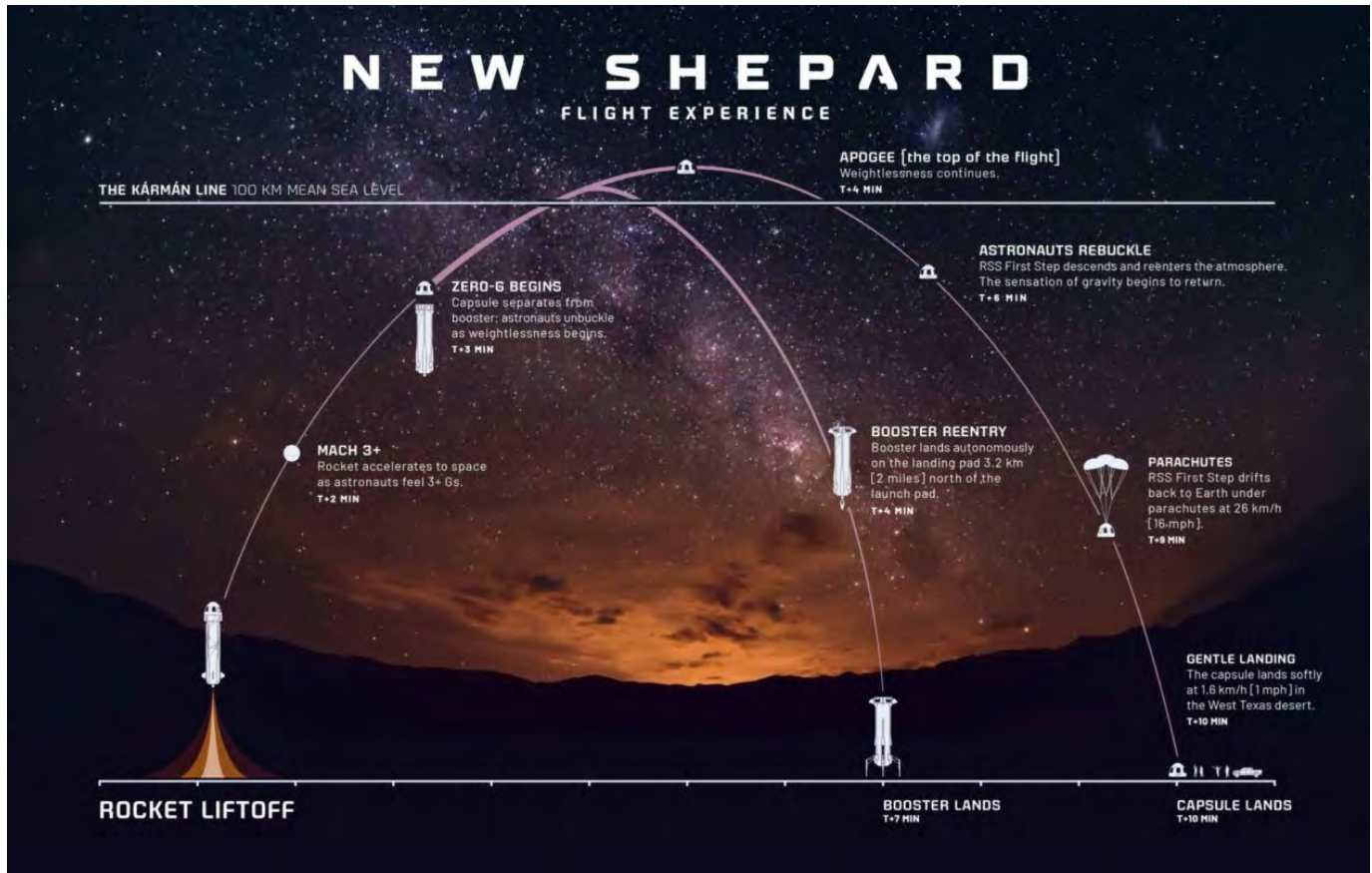
If you are interested in securing your own window seat on a future New Shepard launch, sign up for updates on [BlueOrigin.com](#).



Jeff Bezos gives the "thumbs up" after returning from space.



Blue origin's First Human Flight crew at a post-flight press conference after a successful flight to space and back. (July 20, 2021) (Left to Right) Oliver Daemen, Jeff Bezos (Founder), Mark Bezos, and Wally Funk.



Astronauts Oliver Daemen, Wally Funk, and Mark Bezos inside the New Shepard crew capsule at apogee.



Blue Origin's First Human Flight Mission Patch



New Shepard lifts off from Launch Site One in West Texas with four humans on board.



The New Shepard booster lands back at Launch Site One. The third consecutive successful landing for this particular booster.

Virgin Orbit's Tubular Bells Mission Goes Off Without a Hitch

(2021 June 30) <https://virginorbit.com/the-latest/virgin-orbits-tubular-bells-mission-goes-off-without-a-hitch/>



(Left) Virgin Group founder Richard Branson and Virgin Orbit CEO Dan Hart are all smiles during Virgin Orbit's Tubular Bells: Part One mission. June 30th, 2021. Credit: Virgin Orbit. (Right) Virgin Orbit's carrier aircraft Cosmic Girl takes off from Mojave Air and Space Port in California with LauncherOne underwing for the company's Tubular Bells: Part One mission. June 30th, 2021. Credit: Virgin Orbit.

MOJAVE, CALIFORNIA — JUNE 30, 2021 — Virgin Orbit confirmed it successfully deployed into orbit all 7 customer satellites onboard its LauncherOne rocket during today's *Tubular Bells: Part One* mission.

Virgin Orbit's 747 carrier aircraft Cosmic Girl took off from Mojave Air and Space Port this morning at approximately 6:50 A.M. PDT/1:50 PM UTC and flew out to a launch site over the Pacific Ocean, about 50 miles south of the Channel Islands. After a smooth release from the aircraft, the LauncherOne rocket ignited and propelled itself towards space, ultimately deploying its payload into a precise target orbit approximately 500km above the Earth's surface.

LauncherOne carried a total of 7 satellites to Low Earth Orbit (LEO) for this rideshare mission: four R&D CubeSats for the US Department of Defense, two optical satellites for SatRevolution, and the Royal Netherlands Air Force's first military satellite.

"Two successful launches and two groups of happy customers in 5 months really speaks to our team's abilities. They're making air launch look easy — and I can tell you from experience that it's not," said Virgin Orbit CEO Dan Hart. "We can now proudly say that 17 satellites launched by our system are up in space exactly in their target orbits. We're looking forward to growing that number tremendously as we push to ramp up our flight cadence in the coming months."

"What an unforgettable experience to be here in Mojave to watch the Virgin Orbit team complete another perfect mission to space. Everything went exactly to plan and the fact that we dropped the rocket from our 747 at 7:47 AM PDT made it particularly fitting. Perfect timing!" said Virgin Orbit founder Richard Branson. "We had customers here from three countries and I congratulate all of them and all of our wonderful team."

Tubular Bells: Part One is named after the first track on Mike Oldfield's 1973 record *Tubular Bells*, the album that inspired Richard Branson to create Virgin Records and the first ever released by the label.

ABOUT VIRGIN ORBIT

Virgin Orbit builds and operates the most flexible and responsive satellite launcher ever invented: LauncherOne, a dedicated launch service for commercial and government-built small satellites. LauncherOne rockets are designed and manufactured in Long Beach, California, and are air-launched from our modified 747-400 carrier aircraft — allowing us to operate from locations all over the world in order to best serve each customer's needs. To learn more or to apply to join Virgin Orbit's talented and growing team, visit virginorbit.com.

AIAA Statement on the Successful Virgin Galactic Unity 22 Mission

(Written 2021 July 11) <https://www.aiaa.org/news/news/2021/07/11/aiaa-statement-on-the-successful-virgin-galactic-unity-22-mission>



*Pictured: Unity 22 crew members, Dave Mackay (chief pilot), Colin Bennett (lead operations engineer), Beth Moses (chief astronaut instructor), Richard Branson (Virgin Galactic founder), Sirisha Bandla (VP of government affairs and research operations) and Michael Masucci (pilot).
| Credit: Virgin Galactic*

July 11, 2021 – Reston, Va. – The American Institute of Aeronautics and Astronautics (AIAA) congratulates our corporate member Virgin Galactic on its successful flight test of SpaceShipTwo Unity today. AIAA Executive Director Dan Dumbacher made the following statement:

“On behalf of the 30,000 professional and student members of AIAA, we are excited to congratulate Sir Richard Branson and the Virgin Galactic team on their accomplishments today! The successful Unity 22 mission marks a major step forward in humanity’s quest to extend the human neighborhood beyond planet Earth. Virgin Galactic is helping move us closer to the day when space travel is widely accessible to people everywhere.

We especially congratulate Unity 22 Mission Specialist Sirisha Bandla on her part in this flight. In addition to serving as a Unity 22 crew member, Sirisha is a member of our ASCEND Guiding Coalition. The ASCEND Guiding Coalition is the executive board of advisors for ASCEND, the global community focused on building humanity’s off-world future faster. Sirisha exemplifies the community experience of space because no one goes to space alone.

We commend the pioneering role of Sir Richard Branson in accelerating the nascent space tourism industry. Today’s mission would not have been possible without his long-term vision and risk taking. He has courageously led the Virgin Galactic team through challenges and tragedies to get here. Their collective perseverance is admirable, reminding us of how we must accelerate innovation in space with the utmost focus on safety and our shared humanity.

We recognize the countless professionals in the aerospace industry involved in making this mission a success, from design, to fabrication, to testing, and now to operations. We salute and applaud the Virgin Galactic team for pursuing their dreams with determination and making important contributions to shaping the future of aerospace.”

AIAA Statement on Blue Origin's Successful New Shepard Mission

(Written 2021 July 20) <https://www.aiaa.org/news/news/2021/07/20/aiaa-statement-on-blue-origin-s-successful-new-shepard-mission>



Pictured: Blue Origin's New Shepard rocket launches carrying Jeff Bezos, founder of Amazon and space tourism company Blue Origin, brother Mark Bezos, Oliver Daemen and Wally Funk, from its spaceport near Van Horn, Texas, Tuesday, 20 July 2021. | Credit: Tony Gutierrez; Associated Press—©

July 20, 2021 – Reston, Va. – The American Institute of Aeronautics and Astronautics (AIAA) congratulates our corporate member Blue Origin on its successful first human flight of its New Shepard rocket today. AIAA Executive Director Dan Dumbacher made the following statement:

“On behalf of the 30,000 professional and student members of AIAA, we are excited to congratulate Jeff Bezos and the Blue Origin team on their accomplishments today! The successful New Shepard Mission NS-16 builds upon today’s anniversary when we first touched the moon and accelerates us toward where we’re going next. Blue Origin is opening up access to space travel for more people. We believe this will help extend the human neighborhood beyond planet Earth.

We commend Blue Origin for turning this mission’s seat auction into inspiration. The AIAA Foundation is honored to be among the organizations chosen to receive \$1 million each to inspire future generations to pursue STEM careers. We look forward to engaging students and educators with new, innovative, and creative STEM education opportunities, as well as expanding the robust K-12 and university programs we have enabled for the last 25 years.

We are excited to build on our existing partnership with Blue Origin through our Design/Build/Launch (DBL) competition, giving high school students opportunities to develop and fly microgravity research payloads onboard future missions of New Shepard. We are proud of our recently announced 2021 DBL winners – Puneeth Bheesetty, Anna Porter Puckett, and Jaden Shawyer – from Granby High School, Norfolk, Virginia. They join our 2020 DBL winner, Eleanor Sigrest, who recently graduated as valedictorian of a dual program at Forest Park High School in Woodbridge, Virginia, and the Governor’s School at Innovation Park in Manassas, Virginia. We look forward to seeing their research payloads fly aboard New Shepard and hearing their results at an ASCEND event – a gathering of the global community focused on building humanity’s off-world future faster.

We recognize the countless aerospace industry professionals who are involved in making today’s mission a success. We salute and applaud the Blue Origin team for turning dreams into reality and helping shape the future of aerospace.”

AIAA Foundation Selected to Receive \$1 Million from Blue Origin's Club for the Future (Written 2021 July 14)

[https://www.aiaa.org/news/news/2021/07/14/aiaa-foundation-selected-to-receive-\\$1-million-from-blue-origin-s-club-for-the-future](https://www.aiaa.org/news/news/2021/07/14/aiaa-foundation-selected-to-receive-$1-million-from-blue-origin-s-club-for-the-future)



Pictured: Blue Origin New Shepard launch. | Credit: Blue Origin—©

July 14, 2021 – Reston, Va. – Today, AIAA Foundation was selected to receive a \$1 million grant from Blue Origin's [Club for the Future](#). This generous grant will allow the AIAA Foundation to fuel the next generation of space professionals who will create our off-world future. The AIAA Foundation will engage students and educators with new, innovative, and creative STEM education opportunities, as well as expand the robust K-12 and university programs we have enabled for the last 25 years.

“Our recent auction for the first seat on New Shepard resulted in a donation of \$28 million to our non-profit foundation, Club for the Future,” said Bob Smith, Blue Origin CEO. “This donation is enabling Club for the Future to rapidly expand its reach by partnering with 19 organizations to develop and inspire the next generation of space professionals. Our generation will build the road to space and these efforts will ensure the next generation is ready to go even further.”

“The AIAA Foundation is honored to receive a \$1 million grant from Blue Origin's [Club for the Future](#),” said John Langford, chair, AIAA Foundation. “This is a perfect example of what we mean when we talk about paying it forward. We are excited by the momentum they have created with these generous donations. Congratulations to all the partner organizations! We applaud Blue Origin's dedication to igniting student's imaginations as they help usher in a new era of commercial spaceflight for space tourists, researchers, entrepreneurs, and businesses. This gift allows the AIAA Foundation to multiply our impact on young hearts and minds who see space as more than a dream – rather, a place where they will live, work, and play. We can't wait to see how the students we reach together will lead space innovation in the 21st century!”

“On behalf of the 30,000 professional, student, and corporate members of AIAA, we are thrilled to receive this generous grant from Blue Origin's [Club for the Future](#),” said Dan Dumbacher, AIAA Executive Director. “We are energized at AIAA about this opportunity to impact today's students – who will make up the teams – who will become the most technically proficient, professionally equipped, and culturally diverse workforce on the planet. Our STEM education programs focus on outreach to students of all backgrounds, especially from underserved and underrepresented groups, helping ensure space is available for all. Today's students will tackle tomorrow's challenges of living and working in low Earth orbit, on the moon, and beyond. Our off-world future is looking bright!”

About Club for the Future

Founded by Blue Origin in 2019, Club for the Future is a nonprofit foundation whose mission is to inspire future generations to pursue careers in STEM and to help invent the future of life in space. The Club and its collaborators are doing this through Postcards to Space, space-focused curriculum, and access to space on Blue Origin's rockets. For more information visit, ClubforFuture.org.

Jeff Bezos and Sir Richard Branson not yet astronauts, US says

(2021 July 23)

<https://news.yahoo.com/jeff-bezos-sir-richard-branson-210416477.html>



Bezos and the Blue Origin team may not qualify as astronauts

In a move that pours cold water on the dreams of a few billionaire space explorers, the US has tightened its definition of the word "astronaut".

New Federal Aviation Administration (FAA) rules say astronaut hopefuls must be part of the flight crew and make contributions to space flight safety.

That means Jeff Bezos and Sir Richard Branson may not yet be astronauts in the eyes of the US government.

These are the first changes since the FAA wings programme began in 2004.

The Commercial Astronaut Wings programme updates were announced on Tuesday - the same day that Amazon's Mr Bezos flew aboard a Blue Origin rocket to the edge of space.

To qualify as commercial astronauts, space-goers must travel 50 miles (80km) above the Earth's surface, which both Mr Bezos and Mr Branson accomplished.

But altitude aside, the agency says would-be astronauts must have also "demonstrated activities during flight that were essential to public safety, or contributed to human space flight safety".

What exactly counts as such is determined by FAA officials.

In a statement, the FAA said that these changes brought the wings scheme more in line with its role to protect public safety during commercial space flights.

On 11 July, Sir Richard flew on-board Virgin Galactic's SpaceShipTwo to the edge of space as a test before allowing customers aboard next year.

Mr Bezos and the three other crew members who flew on Blue Origin's spacecraft may have less claim to the coveted title. Ahead of the launch, Blue Origin CEO Bob Smith said that "there's really nothing for a crew member to do" on the autonomous vehicle.

Those wishing for commercial wings need to be nominated for them as well. An FAA spokesperson told CNN they are not currently reviewing any submissions.

There are two other ways to earn astronaut wings in the US - through the military or NASA.

The wings spotted on Mr Bezos and Sir Richard following their flights were custom-made pins by their own companies.

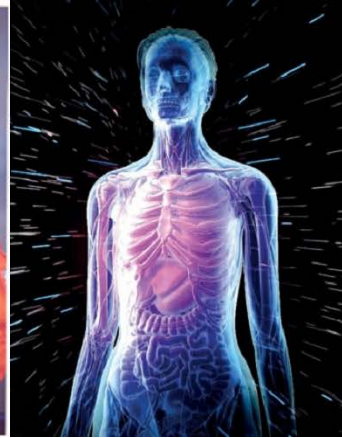
However, a glimmer of hope remains for Sir Richard, Mr Bezos and any future stargazers hoping to be recognised as astronauts.

The new order notes that honorary awards can be given based on merit - at the discretion of the FAA's associate administrator.

Astronaut wings were first awarded to astronauts Alan Shepard Jr and Virgil Grissom in the early 1960s for their participation in the Mercury Seven programme.

Apollo 11 Moon Landing and Viking Mars Landing Anniversaries (52nd / 45th) (2021 July 17) (screenshots only) <https://engage.aiaa.org/losangeles-lasvegas/viewdocument/717-1-michael-collins-life-2>

- (1) "Michael Collins: A Life Well Lived" by Dr. Jennifer Ross-Nazzal
- (2) "NASA Astronaut Program - How to Become an Astronaut" by Prof. Paul D. Ronney
- (3) "Radiation Protection of Astronauts, and Human Space Exploration to the Moon and Mars" by Prof. Dr. Sarah Baatout
- (4) "Drive Perseverance on Mars" by Jeng Yen, PhD



Dr. Jennifer Ross-Nazzal



Prof. Paul D. Ronney



Prof. Dr. Sarah Baatout



Jeng Yen, PhD



(Left) Dr. Ross-Nazzal (JSC) talked about Michael Collins' thoughts and experiences when he took this historic picture of the Lunar Module, containing Buzz Aldrin and Neil Armstrong with Earth in the background, during the Apollo 11 mission. This makes him the only person ever to have lived who was not inside the frame of the photo. (Right) She also talked about "Carrying the Fire: An Astronaut's Journeys," the autobiography of the Gemini 10 and Apollo 11 astronaut Michael Collins. It was released in 1974 with a foreword by the aviator Charles Lindbergh.

Space flight training

USC Viterbi
School of Engineering

➤ Living in space








Remove Spotlight

Paul Ronney

Prof. Paul D. Ronney (USC) talked about the training he went through for a long time, and what it took to pass each stage of the application and training process. He gave very good advices, and also told interesting stories, especially the differences between his academic background/training and the astronaut application/training. He was "carrying the fire", continuing the dreams of the astronauts before him, like Michael, Buzz, and Neil.

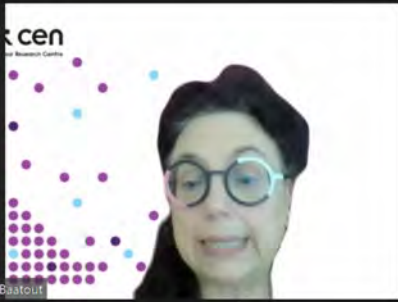
Human space exploration



Deep Space Gateway =

- 1st human spaceship to explore solar system
- most distant human space missions ever attempted
- testing ground for challenges of long-duration human missions in deep space

Showstopper= ionizing radiation



cen

Research Centre

Sarah Baatout

Prof. Dr. Sarah Baatout (SCK-CEN, Belgium & UNSCEAR) talked about history and health risks for astronauts and the human spaceflight, and showed the importance of the proper protection and personalized medicine in support of a long human spaceflight and the presence in space. She explained the risks and dangers in space, including but not limited to space radiation, and the possible approaches mitigate it, as well as other possible dangers and risks.

Sol 123,127, 128 Driving Record



MADE GOOD

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Remove Spotlight

Dr. Jeng Yen

Dr. Jeng Yen (JPL Robotics Group) showed the fun and difficulties in driving the Mar Perseverance Rover, with some inspiring behind-the-scene stories. He also answered some of the questions and clarified some of the mis-conception the public had. He also discussed about the planning and artificial intelligence for the Perseverance Rover and the Ingenuity Helicopter routes, the challenges and interesting recent exciting pictures. He also answered the enthusiastic questions with interesting insights and facts.

Apollo 11 Astronaut Neil Armstrong Broadcast from the Moon (July 21, 1969)

Added to the National Registry: 2004

Essay by Rod Pyle (guest post)*



They may have been the most famous eleven words of the 20th century. Along with Roosevelt's "A date which will live in infamy..." and Martin Luther King's "I have a dream," "That's one small step for man...one giant leap for mankind" has been engraved into global memory.

Or were they twelve words?

Since shortly after the first landing of two humans on the moon on July 20, 1969, a debate has quietly simmered about what, exactly, Neil Armstrong said, a debate that was initiated by Armstrong himself shortly after returning to Earth. After splashdown, Armstrong, Buzz Aldrin, and Michael Collins were ushered from their Apollo capsule into a waiting biocontainment facility (in reality a converted, airtight Airstream trailer aboard the USS Hornet) for medical tests and to begin a 21-day quarantine to assure that they had not brought any dangerous moon-germs back to Earth. Yes, the crew and most of the scientific community thought it was silly too--it would be nearly impossible for any virulent organisms to survive on the hard-vacuum, radiation-blasted surface of the moon, much less evolve there--but the crew eventually saw the delayed return to normal life as a blessing. The pause gave them time to decompress, reflect, and relax before entering the whirlwind of post-flight public relations, including an exhausting five-week global tour.

During that time, they were able to watch recorded news coverage of their lunar adventure in the quiet privacy of the quarantine facility. At one point, Aldrin turned to Armstrong and said, "Neil, we missed the whole thing!" with a grin. But Armstrong was beginning to focus on something else--his first words from the moon did not seem to be as he had intended them.

Not that it mattered to anyone but himself, as the now-famous quote had already traveled around the globe like an electric shock, making its way into every major media outlet in the free world

Apollo 11 Astronaut Neil Armstrong Broadcast from the Moon (July 21, 1969)

(some countries, such as China and the Soviet Union, were a bit more reluctant to cover the story). But, Armstrong wondered, had they gotten the story right?

Many in the press had postulated that NASA would craft a pithy, appropriately historic sentence for him, but months before the landing, Julian Scheer, NASA's assistant administrator for public affairs at the time, said in an internal NASA memo addressing the seminal moment, "The truest emotion at the historic moment is what the explorer feels within himself, not for the astronauts be coached before they leave or to carry a prepared text in their hip pockets...." The press badgered Scheer, but he stuck with his story--the appropriate phrase would be a product of Armstrong's own thoughts, and his alone. When questioned in preflight press conferences, Armstrong himself was characteristically laconic. As it turns out, this was probably because he did not yet *know* what he wanted to say. Armstrong had, by his own telling, not come up with the now-famous line until after he and Aldrin had landed on the moon. "I thought about it after landing," he said in a NASA oral history, "and because we had a lot of other things to do, it was not something that I really concentrated on, but just something that was kind of passing around subliminally or in the background."

The half-billion people who would ultimately watch the moonwalk on television would simply have to wait.

Some had even suggested that a poet should compose the wording, to which Scheer responded, "Columbus wasn't a poet...but his words were pretty dramatic to me. When he saw the Canary Islands, he said, 'I landed and saw people running around naked, some very green trees, much water, and many fruits....'" Fortunately for history, Armstrong left the first dramatic description of the scenery to Aldrin, who said with sufficient poetry, "Magnificent desolation."

So, what was it that caught the First Man's attention while watching the recordings of those first moments of the moonwalk? Simply this: what was reported, and recorded on videotape, was not what he thought he'd said. He later noted that he had intended to say, "That's one small step for *a* man," because "One small step for man" did not make sense in his mind. He went over it again and again, and was sure he had said "a man," but the recording appeared to indicate otherwise.

In the cloistered world of space historians, this has been hotly debated ever since (this kind of small mystery is what gets historians excited, after all). Countless replays of the recording have been consumed by scholars over the ensuing decades, bent over archive desks with headphones gripped tightly to tease out every breath of Armstrong's words.

More objective analyses have been performed via computer, studying the electronic traces of voice print analysis software. This debate continues and is unlikely to be settled to the nitpickers' satisfaction anytime soon, but one 2006 analysis did claim, definitively in the author's opinion, that Armstrong had in fact said "a man"--the verbal article was simply difficult to hear. The moon is, after all, about 240,000 miles (386,242.6 kilometers) away from Earth, and the radio transmitters in the astronauts' backpacks had only modestly powerful radio transmitters, producing poor audio quality. But the 2006 analysis revealed a tiny wave trace on the computer screen, lasting just 35 milliseconds, where the "a" would have been, and that

Apollo 11 Astronaut Neil Armstrong Broadcast from the Moon (July 21, 1969)

convinced the researcher, Peter Shann Ford, and Roger Launius, the Senior Historian at the Smithsonian Institution.

Whatever the truth is, we know what Armstrong intended to say, and that is enough. Regardless of any debate, “That’s one small step for man, one giant leap for mankind” still brings chills to those who were privileged to hear it at the time, and thrills succeeding generations. After nine years of grueling national effort, over 20 billion dollars, and almost half a million Americans directly involved in the effort to land Americans on the moon before 1970, these were the words that marked the ultimate human achievement in the 20th century.

Rod Pyle is the author of 17 books on space history and other topics and the Editor-in-Chief of “Ad Astra” magazine for the National Space Society. He has written books and articles for NASA’s Jet Propulsion Laboratory and Caltech, and his stories have been published in Space.com, LiveScience.com, “WIRED,” the BBC’s “Sky at Night” magazine, and many other media outlets.

*The views expressed in this essay are those of the author and may not reflect those of the Library of Congress.

Apollo to Artemis: Drilling on the Moon

by By Leejay Lockhart, NASA's Kennedy Space Center, 2021 July 26

<https://www.nasa.gov/feature/apollo-to-artemis-drilling-on-the-moon>



This mini-panorama combines two photographs taken by Apollo 15 lunar module pilot Jim Irwin, from the Apollo Lunar Surface Experiments Package (ALSEP) site, at the end of the second Apollo 15 moonwalk on August 1, 1971. Scott is leaning to his right and is putting down the Apollo Lunar Surface drill used to take core samples and set up a heat flow experiment. The Solar Wind Spectrometer is in the right foreground. The min-pan of photographs AS15-11845 and 11847 was combined by Erik van Meijgaarden, volunteer contributor to the Apollo Lunar Surface Journal site.

Credits: Erik van Meijgaarden

Fifty years ago, Apollo 15 lifted off from Kennedy Space Center, sending Commander David R. Scott, Command Module Pilot Alfred M. Worden, and Lunar Module Pilot James B. Irwin on the first of three Apollo “J” missions. These missions gave astronauts the opportunity to explore the Moon for longer periods using upgraded and more plentiful scientific instruments than ever before. Apollo 15 was the first mission where astronauts used the Apollo Lunar Surface Drill (ALSD) and the Lunar Roving Vehicle (LRV).

Scott and Irwin would land on the Moon and use the ALSD at the site where they set up several scientific instruments during the nearly 67 hours they were on the surface of the Moon. The tool was a rotary-percussive drill that used a combined motion that hammered a rotating drill bit into the surface to make a hole. The overall purpose of gathering core samples was part of NASA’s lunar geology studies to learn more about the composition of the Moon and discover more about its history by looking at different kinds of rocks, including some from below the surface.

Now, NASA is going back to the Moon as part of the agency’s Artemis missions and has a new drill headed to the lunar surface as a commercially delivered payload via the Commercial Lunar Payload Services initiative. The Regolith and Ice Drill for Exploring New Terrain (TRIDENT) is key to locating ice and other resources on the Moon.

“Honeybee Robotics designed the TRIDENT drill for NASA to sample lunar regolith,” said Amy Eichenbaum, the Polar Resources Ice Mining Experiment-1 (PRIME-1) deputy project manager. “TRIDENT will help understand the physical properties of the lunar regolith while also allowing analysis of the resources present in samples taken from various depths.”

TRIDENT is also a rotary-percussive drill, but one major difference between it and its Apollo counterpart is that TRIDENT does not need astronauts to operate it manually. Honeybee Robotics originally partnered with NASA through the Small Business Innovation Research program, a highly competitive program that encourages small businesses to engage in federal research.

Polar Resources Ice Mining Experiment-1 (PRIME-1) will be the first in-situ resource utilization demonstration on the Moon. For the first time, NASA will robotically sample and analyze for ice from below the surface. PRIME-1 will use TRIDENT to drill in a single location at a site with a high likelihood of having water – whether in liquid or ice form. It will drill down about 3 feet (1 meter) below the surface, each time bringing up samples that NASA will analyze with a scientific instrument – the Mass Spectrometer observing lunar operations (MSolo).



The Regolith and Ice Drill for Exploring New Terrain (TRIDENT) Engineering Development Unit performs recent testing at Honeybee Robotics. TRIDENT is a drill on the Polar Resources Ice Mining Experiment-1 (PRIME-1), the first in-situ resource utilization demonstration on the Moon, scheduled to take flight in late 2022.

Credits: Honeybee Robotics

Apollo to Artemis: Drilling on the Moon

“MSolo will measure water ice and other volatiles released from the sample brought to the surface by the TRIDENT drill,” said Dr. Janine Captain, the principal investigator for MSolo. “These measurements will help us start to understand the distribution of resources on the lunar surface, a key to enabling a long-term presence on the Moon.”

Apollo 15 landed near the Hadley Rille, a long, deep channel-like gorge in the Moon’s surface, which was at the base of the Apennines Mountains to the north of the Moon’s equator. PRIME-1’s destination is the Moon’s South Pole - new territory far from all the Apollo landing sites – a location very interesting because NASA has previously detected water there from space. However, gathering more accurate data requires PRIME-1, like ALSD, to land and drill into the surface to examine what is there.

What PRIME-1 discovers will help to update resource models for where explorers are most likely to find water on the Moon. About a year after the PRIME-1 mission, NASA will send an exploratory rover – Volatiles Investigating Polar Exploration Rover, or VIPER – to the surface. VIPER is NASA’s first mobile robotic mission to the Moon, and will carry a TRIDENT drill and scientific instruments that enable it to directly analyze water ice on the surface and subsurface of the Moon at varying depths and temperature conditions. VIPER will explore multiple sites on the lunar South Pole for about 100 days.

PRIME-1 and VIPER will build upon the legacy of Apollo 15 by using drills and rovers, allowing NASA the chance to look below the surface and detect what is there. Much like Apollo 15, NASA is preparing to send new capabilities to the Moon that will enable people to stay there for longer than ever before, because learning how to find and use water is a key to living and working on the Moon and other deep space destinations.

“The Apollo missions first introduced the concept of drilling to provide subsurface understanding of a foreign world,” said Dan Andrews, VIPER Project Manager. “PRIME-1 and VIPER will expand the state of the art as we look to a future of sustainable exploration and learning how to live off the land.”



The brush assembly for The Regolith and Ice Drill for Exploring New Terrain (TRIDENT) Engineering Development Unit shown in close up during recent testing at Honeybee Robotics. TRIDENT is a drill on both the Polar Resources Ice Mining Experiment-1 (PRIME-1) the first in-situ resource utilization demonstration on the Moon and Volatiles Investigating Polar Exploration Rover, or VIPER, NASA’s first mobile robotic mission to the Moon.

Credits: Honeybee Robotics

Juneteenth Remembrance of 1st Black air warriors — Red Tails

(Based on the AIAA LA-LV Section event on 2021 June 19)

by Larry Grooms , June 26, 2021

<https://www.aerotechnews.com/blog/2021/06/26/juneteenth-remembrance-of-1st-black-air-warriors-red-tails/>



Pilots of a U.S. Army Air Forces fighter squadron, credited with shooting down 8 of the 28 German planes destroyed in dog-fights over the new Allied beachheads south of Rome, on Jan. 27, talk over the day's exploits at a U.S. base in the Mediterranean theater. Members of this squadron, veterans of the North African and Sicilian campaigns, were formerly classmates at the Tusgee Institute in Alabama. (Courtesy photograph)

LOS ANGELES, Calif.—On the first national holiday commemorating the long wait between slavery's official abolition and freedom's arrival on a date remembered as Juneteenth, the Los Angeles–Las Vegas Chapter of the American Institute of Aeronautics and Astronautics related the legacy of [America's Tusgee Airmen](#) who fought racism at home and Hitler's Luftwaffe over Europe in World War II.

By the end of the war on May 8, 1945, the war record of 21,000 Tusgee program pilots, air crewmen and ground support personnel had set the stage for [President Harry S. Truman's July 1948 Executive Order 9981, ending racial segregation in the armed services](#), and reassignment to all integrated units the following year.

Keynote speaker and panelist for the two-part Zoom conference on June 19, was Harvey Hawks, docent at the Museum of Flight in Seattle, Wash. Knowledge from his 25 years as a museum docent stimulated lively and thought-provoking discussion by members of an AIAA panel, with topics ranging from historical truths, myths and misunderstandings to overlooked legendary exploits by [Tusgee Airmen](#) recognized by their aircraft battle colors: The Red Tails.

Hawks is also a member of the Sam Bruce Chapter of Tusgee Airmen, Inc., a non-profit dedicated to sharing stories of the original Airmen and inspiring future generations of African American aerospace professionals.

Hawks explained that black fighter pilot Sam Bruce, honored in the museum's Personal Courage Wing, died Jan. 27, 1944, while flying aircover for American troops under fire by German forces on the Allied beachhead at Anzio, Italy. Although Black Americans fought in every American War, Sam Bruce was among the first to fight in the sky, and to give his life to his country.

Juneteenth Remembrance of 1st Black air warriors — Red Tails

(Based on the AIAA LA-LV Section event on 2021 June 19)



Maj. James A. Ellison returns the salute of Mac Ross, as he reviews the first class of Tuskegee cadets on the flight line at U.S. Army Air Corps basic and advanced flying school in Tuskegee, Ala., in 1941. (Courtesy photograph)

From that and other examples, the panel was drawn into discussion of a pivotal question: Why would a young American Black man living in a time of overwhelming racial segregation, and facing discrimination in every part of daily life, volunteer to sacrifice his life for his country?

One answer to that question was cited from the book, *Red Tail Captured, Red Tail Free: Memoirs of A Tuskegee Airman and P.O.W.* The memoirs of African-American flier Alexander Jefferson detail how he bailed out over France in 1944 when his P-51 Mustang fighter was shot down while escorting bombers. Captured, he spent nine months in Luftwaffe Stalags where his Nazi interrogators demanded to know: Why would you fight for a country that hates you?

Jefferson's answer was short and powerful: "Because it's MY Country."

Jefferson, a Detroit native who was one of 32 Tuskegee Airmen from the 332nd Fighter Group to become prisoners of war, explained in his memoirs that his response to the Nazi interrogators was based on the vision of America's future as seen through the eyes of a patriot who fights to protect and fulfill the promise of American freedom.

Panelists agreed Tuskegee University, a segregated institution in Alabama, was selected in early 1941 as an unlikely location for an experiment to determine whether Black trainees would qualify to become combat pilots and aircrews. The historical view is that the War Department, opposed to even the concept but duty-bound to obey a directive by President Franklin D. Roosevelt, deselected institutions in more racially integrated areas and recommend a university in the Deep South. It was, some panelists observed, an early example of industry integration programs built on an expectation of failure for Black applicants.

Panelist Shelby Jacobs, who did groundbreaking work in optics for the Space Program, said his successes came in part because he recognized that some of his assignments were based on an expectation that he wouldn't succeed. The theme was echoed by another panelist who noticed that his starting position's primary purpose seemed to be corporate window-dressing for management integration. Panelists also remarked that an opposite practice was used in NASA's early Space Program, where [Black woman mathematicians made essential contributions](#) despite working under discrimination in isolation and obscurity. Their struggle in the two decades after the Red Tails saga was made widely known in the movie, "Hidden Figures."



(Picture on the right) 332nd Fighter Group pilots (Front row, left to right): unidentified airman; Jimmie D. Wheeler (with goggles); Emile G. Clifton (cloth cap) San Francisco, Calif., Class 44-B. Standing left to right: Ronald W. Reeves (cloth cap) Washington, D.C., Class 44-G; Hiram Mann (leather cap); Joseph L. "Joe" Chineworth (wheel cap) Memphis, Tenn., Class 44-E; Elwood T. Driver, Los Angeles, Calif., Class 44-A; Edward "Ed" Thomas (partial view); Woodrow W. Crockett (wheel cap); at Ramitelli, Italy, March 1945. (Courtesy photograph)

Juneteenth Remembrance of 1st Black air warriors — Red Tails

(Based on the AIAA LA-LV Section event on 2021 June 19)

At the dawn of Black history in aviation, Tuskegee's first class in March 1942 had 13 cadets — five graduated. Contrary to public perception, cadets came from across the nation. Between 1941 and 1946, Tuskegee trained just under 1,000 Black pilots, about a third of whom were to fly bombers, mostly twin-engine B-25 Mitchells. But in the straightjacketed book of USAAF regulations at the time, separate-but-equal staffing and facilities for an air base was not only impractical, but wasteful and unaffordable. In the end, ranks of Tuskegee Airman eventually swelled well beyond officers wearing wings to more than 20,000 needed for bomber crews and all those who supported and maintained the bases to keep 'em flying.

Learning to fly in PT-15, PT-19 and Stearman PT-17s, and given advanced training in the North American AT-6 Texan, the early Tuskegee fighter pilots transitioned to Bell P-39 Airacobras, later deploying in 1942 to North Africa where they flew Curtiss P-40 Warhawks in ground support missions for Allied troops fighting the Afrika Korps. Moving north to fly and fight in Sicily, Italy, and the underbelly of Europe, Tuskegee's growing groups of fighters and bombers transitioned to the powerful and versatile P-47 Thunderbolt fighter-bombers and the USAAF's air superiority P-51-C and D Mustang for long-range bomber escort missions.

Combat record numbers of the Tuskegee Airmen Red Tails speak for themselves:

700-plus War Department commendations,

Air support and aerial combat in the 12th Air Force in Italy,

Prior to joining the 332nd Fighter group, the 99th Squadron was awarded two Presidential Unit Citations (June-July 1943 and May 1944) for outstanding tactical group,

The 332nd Fighter Group was awarded the Presidential Unit Citation for its' longest bomber escort mission to Berlin on March 24, 1945. During this mission, the Red Tails destroyed three German ME-262 jet fighters and damaged five additional jet fighters,

The 332nd Fighter Group distinguished itself in June 1944 when two pilots flying P-47 Thunderbolts discovered a German destroyer in the harbor of Trieste, Italy.

Only in two categories were the combat records of the Red Tails seemingly and perhaps inexplicably at odds. An unexpectedly low number of Red Tails pilots qualifying for the "Ace" title by shooting down five enemy aircraft seemed counter-intuitive to the group's strong reputation for being among the best, if not the best, fighter escorts, losing the fewest bombers.

Pointing out that many American bomber crews actively requested that Red Tails be assigned to protect bombing missions, the answer came from knowing why bomber crews preferred protection by [Tuskegee Airmen](#).

Bomber pilots noticed that when Luftwaffe interceptors were sighted, some of their fighter escorts would break formation to chase the incoming enemy. Bomber crews also noticed that other German fighters would quickly show up to attack while the U.S. escorts were off to score points in the race for Ace status. Red Tails, on the other hand, maintained their disciplined defensive stance to fend off attackers.



The 332nd's aircraft had distinctive markings that gave them the name "Red Tails." (Air Force photograph)

Juneteenth Remembrance of 1st Black air warriors — Red Tails

(Based on the AIAA LA-LV Section event on 2021 June 19)

Although the Red Tails held the unmatched record of having one of the lowest loss records among all escort fighter groups, while being in constant demand for their services, reports that they never lost a customer were exaggerated. As panelists pointed out, bomber crews faced many threats beyond the help of escort pilots, including ground-based anti-aircraft fire, mechanical failures, inflight accidents and weather.

Panelist Karen Robinson, whose father was a Tuskegee Airman, recalled asking what moved him to fight for the United States, and he told her it was “a promise for you to be what you can be.” She said she is proud of the legacy her dad and others left by paving the way.

Michael Wallace, a 35-year career engineer and executive in aerospace, said he first heard of the Tuskegee Airmen when he enlisted in the Air Force. “They were the ones that helped to inspire me,” to go forward to earn engineering degree, Wallace said.

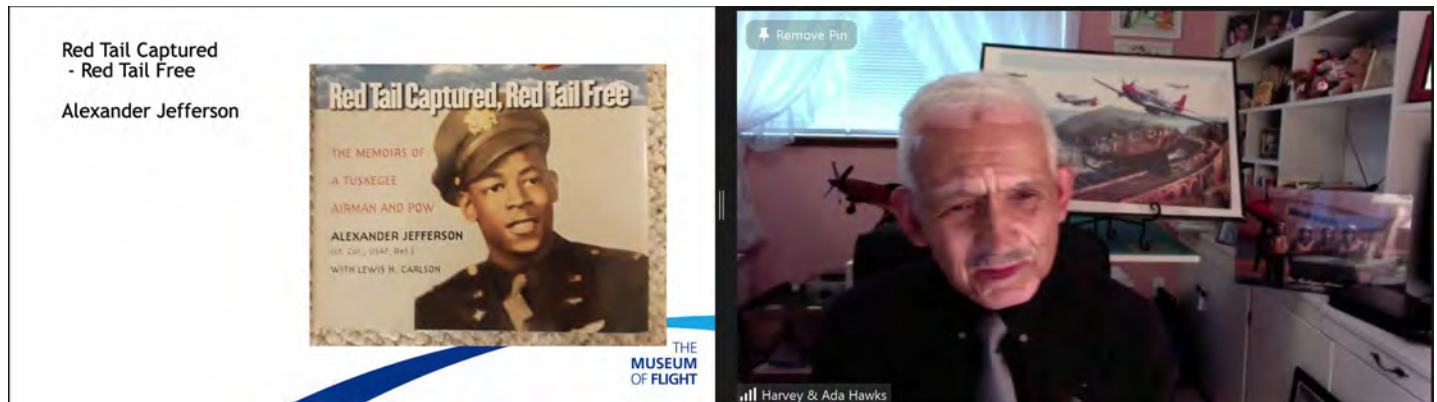
Several panelists commented that even children living in areas where the Red Tails are a part of local history aren’t being taught about the accomplishments of the unit.

For the future, the AIAA Juneteenth Seminar offered a salute to the U.S. Air Force’s new Boeing T-7A Red Hawk advanced jet trainer to replace the Northrop T-38 Talon. Employing new Air Force Digital Century Series design and testing concepts and capabilities, the T-7A builds off the legacy of the Tuskegee Airman, illustrated in the iconic Red Tail paintjob.

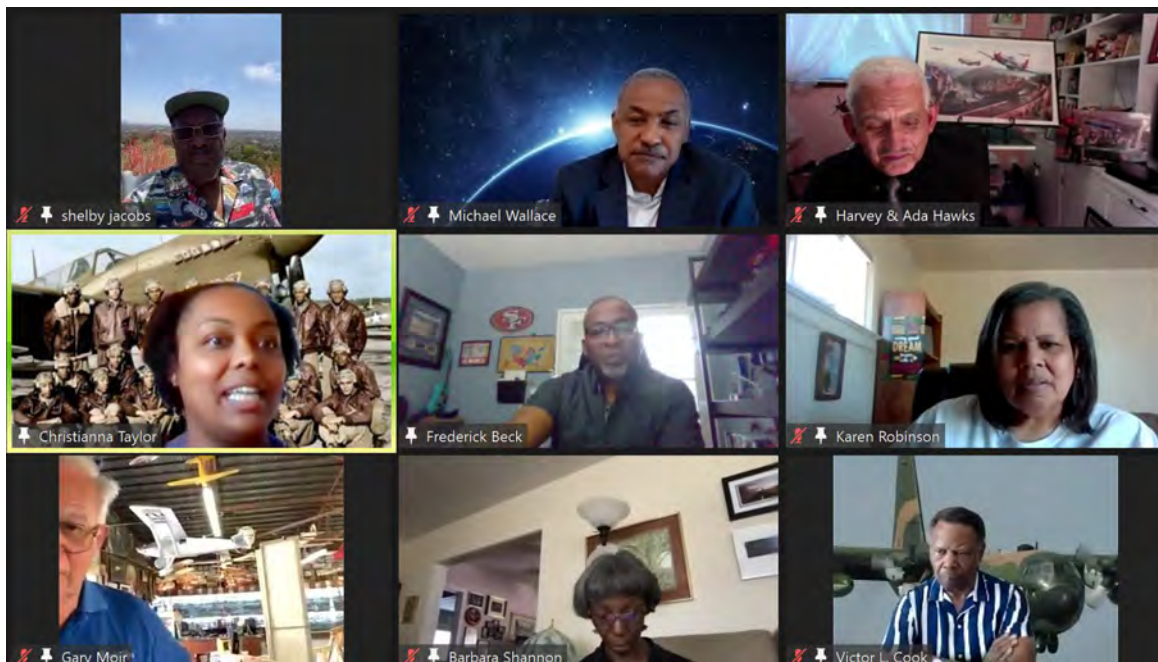
The AIAA Juneteenth panel segment was moderated by Dr. Christianna Taylor, CEO of Intelligence Space.

The Tuskegee Airmen, Juneteenth Celebration, and African American Aerospace Professionals Panel Discussion (2021 June 19)

- (1) The Tuskegee Airmen by Mr. Harvey Hawks
 (2) Juneteenth Celebration & African American Aerospace Professionals Panel Discussion (moderator: Dr. Christianna Tyler)
<https://engage.aiaa.org/losangeles-lasvegas/viewdocument/june-19-2021-the-tuskegee-airmen>



Mr. Harvey Hawks talked about the inspiring story as an example about a Tuskegee Airman and P.O.W. The memoirs of African-American flier Alexander Jefferson (refer to the previous pages in the article written by Mr. Larry Grooms). He discussed about history and legacy of the legendary Tuskegee Airmen, including the important message and slogan "We fought Two Wars", citing the significant contribution behind the scene for the American Civil Rights movement post WWII.



Panelists sharing their stories about, admiration toward, and thoughts over the Tuskegee Airmen. They also shared their experiences and views about Juneteenth and African American Professionals development. From Top Left, Top Right, to Lower Right: Mr. Shelby Jacobs ("The Hidden Figure"), Mr. Mike Wallace (Raytheon), Mr. Harvey Hawks (Event Speaker), Dr. Christianna Taylor (Moderator, Intelligence Space), Mr. Frederick Beck (NASA JPL), Ms. Karen Robinson (Sam Bruce Chapter, Tuskegee Airmen, Inc., Daughter of a former Tuskegee Airman), Mr. Gary Moir (AIAA LA-LV Technical Chair, Gary A Moir & Assoc, Inc.)(Showing a Wright Flyer Replica from a local museum in a very hot day outside), Dr. Barbara Shannon (Synergy Academies), Mr. Victor K. Cook (Lockheed Martin - Retired).

An Assessment of Heading Angle Ambiguities Associated with NASA Apollo Trajectory Elements (NATs)

by Daniel R. Adamo (adamod@earthlink.net), 2021 July 21

Introduction

Research entailing as-flown trajectory reconstruction for Apollo Program missions often relies on initial conditions derived from NASA Apollo Trajectory elements (NATs) [1], [2], [3]. Due to their postflight "best estimate trajectory" pedigree, NATs are regarded as the most accurate as-flown trajectory source for Apollo missions available to twenty-first century researchers [1, p. 1773].

Unfortunately, the "space-fixed heading angle" ψ associated with NATs has become a source of confusion among researchers. This angle is defined by NASA as: "Angle of the projection of the inertial velocity vector onto the local body-centered, horizontal plane, measured positive eastward from north, deg" [4, p. 7-8, Table 7-I].

In the context of roundtrip missions to the Moon, in which NATs may be referenced to Earth (geocentric) or the Moon (selenocentric) at various times, NASA's definition of ψ leaves an important ambiguity to be resolved by NATs users. Particularly in lunar orbit, how is "north" defined? When processing NATs in lunar orbit, this author's research has found the north reference for zero ψ in the local horizontal plane to be inconsistent. In a selenocentric context, NATs for some missions are associated with *Earth's* north celestial pole (NCP) projected into the local horizontal plane to define zero ψ . Still other missions are associated with selenocentric NATs defining zero ψ by projecting the *Moon's* NCP into the local horizontal plane [2, p. 41].

In more recent research on post-jettison orbit stability for the Apollo 11 lunar module (LM) *Eagle's* ascent stage, NATs used to initialize long-term orbit coasts at jettison are associated with a $\psi = -97.81^\circ$ value considered to be "incorrect, for unknown reasons". This finding arises because Apollo 11 inclination is known to be near 180° at LM jettison. Thus, ψ should be near -90° at that time. A ψ estimate of -89.63° is therefore derived from non-NATs inclination trends contemporaneous with LM jettison and NATs-derived selenocentric position [3, p. 3].

The $\psi \cong -90^\circ$ expectation for Apollo 11 is based on the assumption zero ψ is defined by projecting the Moon's NCP into *Eagle's* local horizontal plane at jettison. This paper will demonstrate $\psi = -97.81^\circ$ is consistent with zero ψ defined by projecting Earth's NCP into *Eagle's* local horizontal plane at jettison. By adopting this understanding, an Apollo 11 selenocentric state vector at LM jettison can be obtained based only on associated NATs.

A Fully NATs-Derived Apollo 11 State Vector at LM Jettison

This section develops a selenocentric Cartesian position \mathbf{r}_{J2K} and velocity \mathbf{v}_{J2K} in the Earth mean equator and equinox of epoch J2000.0 (J2K) coordinate system from Table 1's Apollo 11 NATs at LM ascent stage jettison [4, p. 7-9, Table 7-II). A numeric example relevant to Reference [3] is thereby provided.

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Table 1. The following NATs parameters pertain to LM ascent stage jettison 130h 09m 31.2 s after Apollo 11 launch (jettison on 21 July 1969 at 23:41:31.2 UT). All values are selenocentric. However, as noted in the Introduction section, ψ is measured in a plane normal to selenocentric position using a zero-value defined by projection of Earth's NCP into that plane.

Symbol	Definition	NATs (Metric) Value
ϕ	Latitude	1.10° N
λ	Longitude	41.85° E
h	Altitude	+61.6 NM (+114.0832 km)
s	Inertial speed	5335.9 ft/s (1.62638232 km/s)
γ	Inertial flight path angle	+0.15°
ψ	Inertial heading angle	-97.81°

For the sake of consistency, selenocentric distance $r = h + R_{LS}$ adopts a Tranquility Base landing site selenocentric distance $R_{LS} = 1736.0705$ km [3, p. 3].¹ As a quasi-inertial selenocentric Cartesian coordinate system intermediary between NATs and J2K at the Table 1 epoch, lunar equator and prime meridian (LEPM) axes are defined by the unit vector cross-product $\mathbf{I} \times \mathbf{J} = \mathbf{K}$ with \mathbf{I} directed at $\phi = \lambda = 0$, \mathbf{J} directed at $\phi = 0$; $\lambda = 90^\circ$ E, and \mathbf{K} directed at $\phi = 90^\circ$ N. Conversion of (ϕ, λ, r) to LEPM components is then a straightforward polar-to-rectangular transformation as follows.

$$\mathbf{r}_{LEPM} = r \begin{bmatrix} \cos \lambda \cos \phi \\ \sin \lambda \cos \phi \\ \sin \phi \end{bmatrix} = \begin{bmatrix} +1377.914515 \\ +1234.163182 \\ +35.518219 \end{bmatrix} \text{ km}$$

The terrestrial equivalent to LEPM is defined for Earth and termed "TEPM" herein. Transformations from J2K to LEPM and J2K to TEPM are provided as follows for the LM jettison epoch. These transformations are generated using Planetary Constants Kernels (PCKs) supplied by JPL's Navigation and Ancillary Information Facility (NAIF) via URL https://naif.jpl.nasa.gov/pub/naif/generic_kernels/pck/ (accessed 19 July 2021).

$$M_{J2K}^{LEPM} = \begin{bmatrix} +8.61902634008376E-01 & +4.71091176644498E-01 & +1.87608509340931E-01 \\ -5.07069483257091E-01 & +7.99205505729902E-01 & +3.22724493586089E-01 \\ +2.09490782841898E-03 & -3.73287640967008E-01 & +9.27713290010700E-01 \end{bmatrix}$$

$$M_{J2K}^{TEPM} = \begin{bmatrix} +4.26559131193434E-01 & -9.04458808642127E-01 & +1.25342138459468E-03 \\ +9.04454834203593E-01 & +4.26560972626450E-01 & +2.68132760542618E-03 \\ -2.95981101650650E-03 & -1.00817432247434E-05 & +9.99995619698959E-01 \end{bmatrix}$$

Only the bottom row of the foregoing M_{J2K}^{TEPM} matrix is germane to this discussion, and its transpose is defined as the J2K unit vector \mathbf{P}' directed at Earth's NCP. This unit vector is readily transformed to LEPM.

An Assessment of Heading Angle Ambiguities Associated with NASA Apollo Trajectory Elements (NATs)

$$\mathbf{P} = M_{J2K}^{LEPM} \mathbf{P}' = \begin{bmatrix} +0.185051869 \\ +0.324215852 \\ +0.927706789 \end{bmatrix}$$

It is now possible to define the LM jettison topocentric coordinate system with an Earth NCP ψ reference (TTOP) as follows. Transposed LEPM vectors forming rows within the ensuing 3x3 matrix are denoted with a superscript "T".

$$M_{LEPM}^{TTOP} = \begin{bmatrix} [\mathbf{E} \times \mathbf{C}]^T \equiv \mathbf{N}^T \\ [\text{unit}(\mathbf{P} \times \mathbf{r}_{LEPM})]^T \equiv \mathbf{E}^T \\ [\text{unit}(-\mathbf{r}_{LEPM})]^T \equiv \mathbf{C}^T \end{bmatrix} = \begin{bmatrix} -0.099025699 & +0.082019599 & +0.991698894 \\ -0.659947912 & +0.740475517 & -0.127140717 \\ -0.744756782 & -0.667059813 & -0.019197442 \end{bmatrix}$$

Selenocentric velocity in TTOP components is then a polar-to-rectangular conversion of pertinent Table 1 NATs values.

$$\mathbf{v}_{TTOP} = s \begin{bmatrix} \cos \psi \cos \gamma \\ \sin \psi \cos \gamma \\ \sin \gamma \end{bmatrix} = \begin{bmatrix} -0.221005878 \\ -1.611290701 \\ -0.004257854 \end{bmatrix} \text{ km/s}$$

The foregoing velocity can now be transformed into the LEPM coordinate system.

$$\mathbf{v}_{LEPM} = [M_{LEPM}^{TTOP}]^T \mathbf{v}_{TTOP} = \begin{bmatrix} +1.088424262 \\ -1.208407885 \\ -0.014228890 \end{bmatrix} \text{ km/s}$$

Finally, the selenocentric LEPM state vector is transformed to J2K components.

$$\mathbf{r}_{J2K} = [M_{J2K}^{LEPM}]^T \mathbf{r}_{LEPM} = \begin{bmatrix} +561.896070 \\ +1622.214868 \\ +689.753900 \end{bmatrix} \text{ km}$$

$$\mathbf{v}_{J2K} = [M_{J2K}^{LEPM}]^T \mathbf{v}_{LEPM} = \begin{bmatrix} +1.550832692 \\ -0.447707700 \\ -0.198985500 \end{bmatrix} \text{ km/s}$$

A Heading Value for LM Jettison ψ_K Referred to the Lunar NCP

If the Table 1 NATs were instead consistent with \mathbf{K} projected into the local horizontal plane at LM jettison as the zero-heading reference in accord with [3, p. 3], what would the associated ψ_K value be? As a first step to addressing this inquiry, recognize \mathbf{r}_{LEPM} is unaffected because selenocentric position is independent of ψ . The LM jettison topocentric coordinate system with a Moon NCP ψ reference (LTOP) is then defined as follows.

$$M_{LEPM}^{LTOP} = \begin{bmatrix} [\mathbf{E} \times \mathbf{C}]^T \equiv \mathbf{N}^T \\ [\text{unit}(\mathbf{K} \times \mathbf{r}_{LEPM})]^T \equiv \mathbf{E}^T \\ [\text{unit}(-\mathbf{r}_{LEPM})]^T \equiv \mathbf{C}^T \end{bmatrix} = \begin{bmatrix} -0.014300061 & -0.012808203 & +0.999815712 \\ -0.667182767 & +0.744894057 & 0 \\ -0.744756782 & -0.667059813 & -0.019197442 \end{bmatrix}$$

An Assessment of Heading Angle Ambiguities Associated with NASA Apollo Trajectory Elements (NATs)

Also independent of ψ is the LEPM coordinate system. Consequently, \mathbf{v}_{LEPM} can now be transformed into LTOP components.

$$\mathbf{v}_{LTOP} = M_{LEPM}^{LTOP} \mathbf{v}_{LEPM} \equiv \begin{bmatrix} v_N \\ v_E \\ v_C \end{bmatrix} = \begin{bmatrix} -0.014313268 \\ -1.626313762 \\ -0.004257854 \end{bmatrix} \text{ km/s}$$

And $\psi_K = \text{atan2}(v_N, v_E) = -90.50425^\circ$ (0.50° south of west), a result consistent with expectations in [3, p. 3].² However, [3] uses a heading of -89.63° (0.37° north of west) inferred from an estimated inclination of 178.82° . It is not known what argument of latitude u is associated with this estimate, but with Table 1's ϕ being in the Moon's northern hemisphere, $0 < u < 90^\circ$ appears likely. An estimate with $90^\circ < u < 180^\circ$ would be more consistent with the southerly heading computed for ψ_K . Note the selenocentric inclination pertaining to \mathbf{r}_{LEPM} and \mathbf{v}_{LEPM} is 178.79° .

Orbit predictions conducted in [3] all assume northerly heading values at LM jettison ranging from -89.37° to -89.90° [3, p. 5, Table 2], and ψ_K lies outside this range. Failure to consider southerly initial headings centered near ψ_K for these predictions may therefore significantly affect results documented in [3].

Conclusion

An ambiguity regarding definition of the heading angle associated with NASA Apollo Trajectory elements (NATs) is identified, and a means of dealing with this ambiguity in the case of Apollo 11's lunar orbit phase is presented. With care, NATs remain the best source of as-flown Apollo mission trajectory data available. But the heading ambiguity can lead to error and rework if NATs users are unaware of it.

References

- [1] D. R. Adamo, "Apollo 13 Trajectory Reconstruction via State Transition Matrices", *Journal of Guidance, Control, and Dynamics*, Vol. 31, No. 6 (2008), pp. 1772-1781.
- [2] D. R. Adamo, "The Elusive Human Maximum Altitude Record", *Quest: The History of Spaceflight Quarterly*, Vol. 16, No. 4 (2009), pp. 37-41.
- [3] J. Meador, "Long-term Orbit Stability of the Apollo 11 'Eagle' Lunar Module Ascent Stage", preprint submitted to *Planetary and Space Science*, 24 May 2021.³
- [4] Mission Evaluation Team, *Apollo 11 Mission Report*, MSC-00171, NASA-MSC, (1969).⁴
- [5] TRW Systems Group, *Apollo 11, Trajectory Reconstruction and Postflight Analysis, Volume 1*, TRW Note 70-FMT-819, NASA-MSC, 16 March 1970.⁵

² Argument ordering in the atan2 function is in accord with Excel convention used to provide the numeric result. Other math libraries may reverse the order of these arguments. In any case, v_N is the adjacent side of the inferred right triangle, and v_E is the opposite side with respect to ψ_K .

³ This document may be downloaded at <https://arxiv.org/pdf/2105.10088.pdf> (accessed 18 July 2021).

⁴ This document may be downloaded at https://www.hq.nasa.gov/alsj/a11/A11_MissionReport.pdf (accessed 18 July 2021).

⁵ This document may be downloaded at <https://ntrs.nasa.gov/api/citations/19700014995/downloads/19700014995.pdf> (accessed 19 July 2021).

Reimagining the Interactive Classroom

How two professors in the department of aerospace and mechanical engineering built engaging freshman experiences during a global pandemic

by Prof. Paul D. Ronney, Professor & Chair, Department of Aerospace and Mechanical Engineering, USC

<https://spark.adobe.com/page/hEmoUHWAIItS0p/>



The global pandemic has lasted so long, it's hard to remember what life before COVID-19 looked like. But Paul Ronney and Geoff Spedding, professors in the USC Viterbi Department of Aerospace and Mechanical Engineering (AME), used blueprints of in person coursework to help redesign their introductory courses to help freshman engaged in hands-on engineering problems and learn troubleshooting, resilience and team work.

PHOTO/ ANUSHKA TAHILIANI.

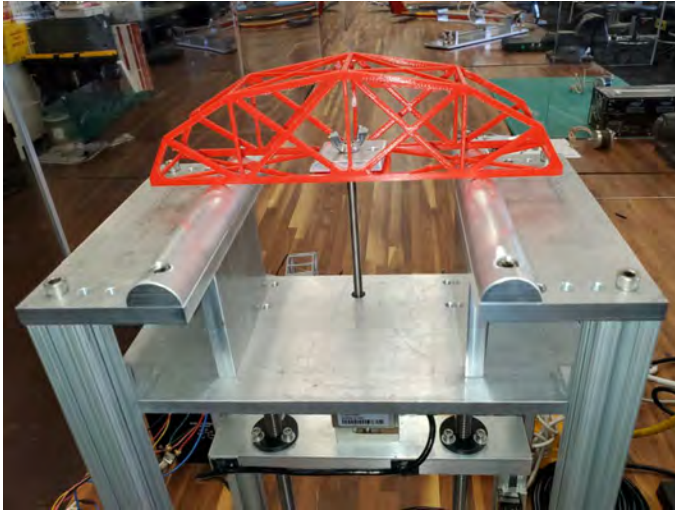


Paul Ronney, Chair of the Department of Aerospace and Mechanical Engineering, teaches AME's introductory course in mechanical engineering and graphics with the goal of giving students a broad overview of topics they will learn about more deeply during their undergraduate studies at Viterbi.

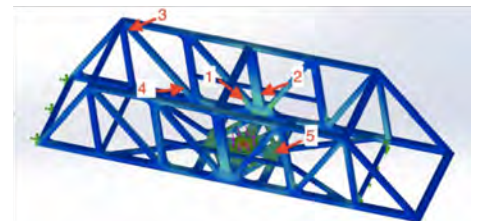
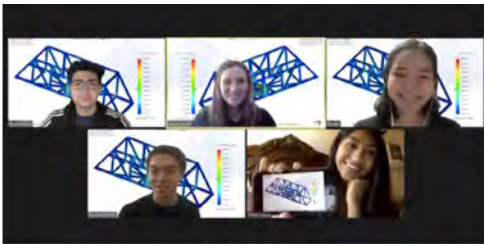
Ronney said, "The biggest challenge as a professor is merging the academic part [of the coursework] with the experiential part. **We have to look at more than what's in the textbook--that's where the science ends and art begins.**"

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In AME 101 (Introduction to Mechanical Engineering and Graphics), Ronney helped students do exactly that by using virtual lectures as a launch pad to group projects that required hands-on application of engineering principles. Students worked on two key projects in the fall 2020 semester, including Arduino robot cars, which use an open source programming platform to operate, and 3D printed bridge design.

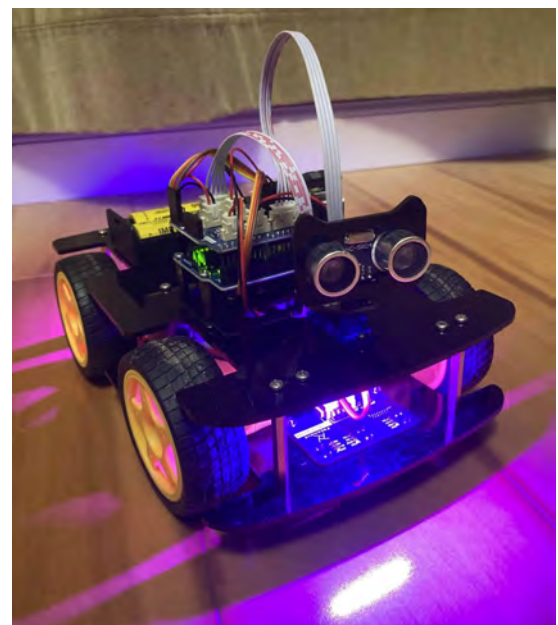


Student groups got a taste for a real engineering job with their bridge projects. "Just like with a client, students had to go through all the steps, from client input to creation and testing of a model," Ronney said. Students used Solidworks, a computer-aided design program, to design their bridges, which were then 3D printed and tested in the AME teach laboratories. Students were able to test their own bridges (to the breaking point!) remotely using an apparatus and software specifically created for this year's class by AME lab technicians. PHOTO/MICHAEL GRONER, YASHA HAQUE, KAITLYN KUMAR, BRYAN ROQUE AND LAUREN SCIULLO.

Students also worked on Arduino robot cars in groups and submitted projects in various categories, including freestyle. One team had their car "swim" a relay, while others had their cars perform choreographed dances.

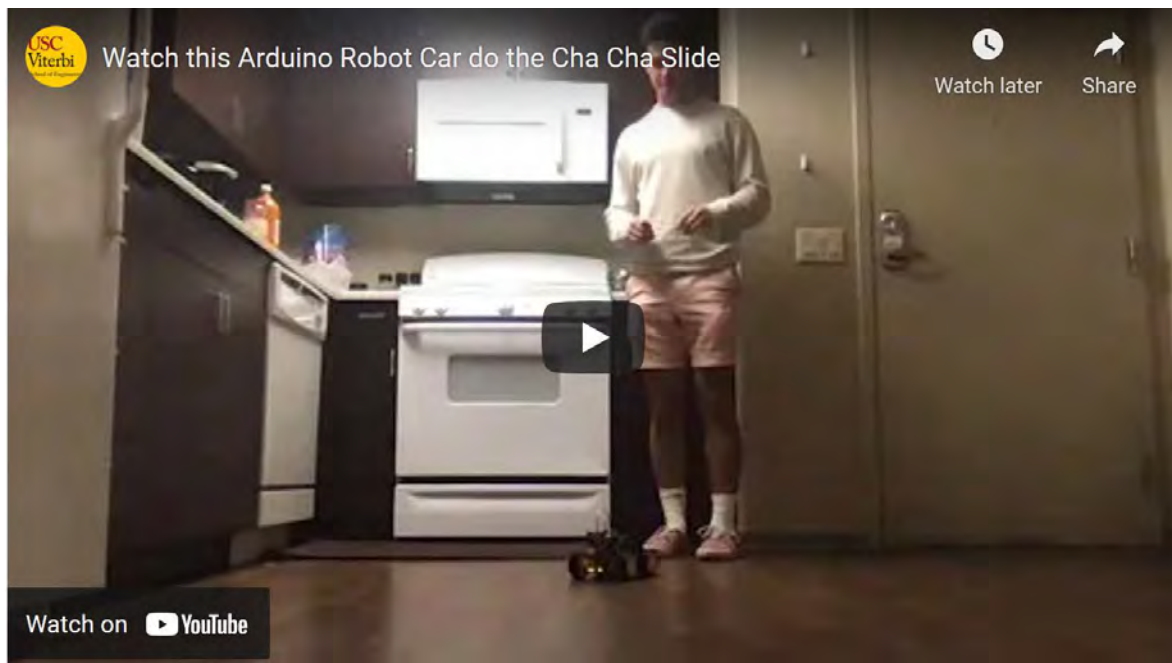
See below for one team's Arduino robot car rendition of the Cha Cha Slide.

PHOTO/THOMAS BULOW, TAYLOR FORD, KAITLYN KUMAR, YUJIN LEE JR., MATT LUONGO.

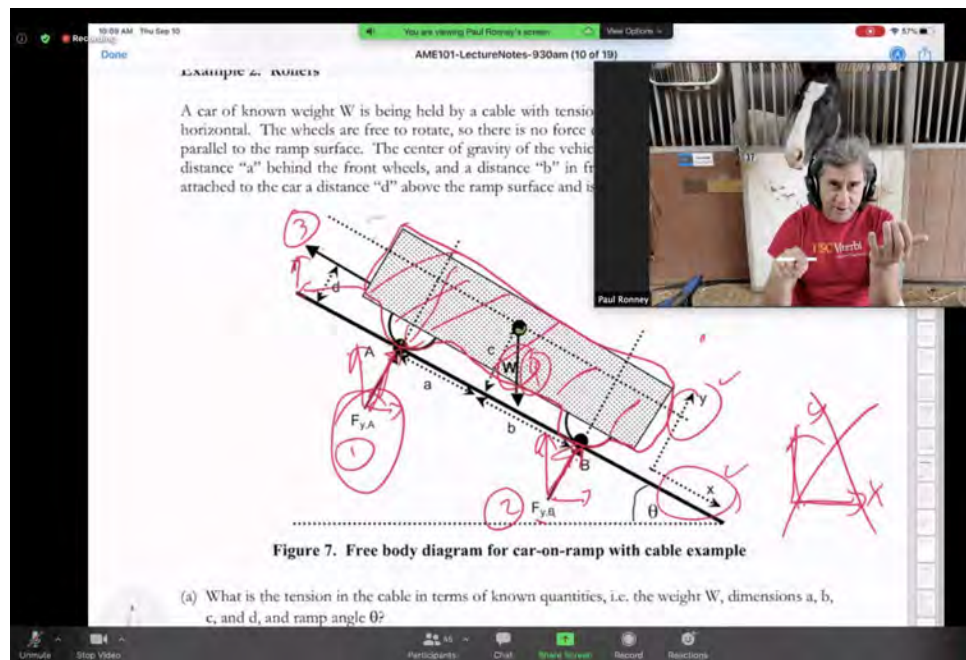


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<https://www.youtube.com/watch?v=Cm9G5G0bfzq>



Ronney said among the aspects of the course that he changed because of the pandemic was recruiting a new teaching assistant, Cavalier, the horse standing behind him. Cavalier was a big hit with students and appeared in various ways in lectures, office hours and even on exams. PHOTO/KAITLYN KUMAR.

Reimagining the Interactive Classroom

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Geoff Spedding, professor of aerospace and mechanical engineering, leads AME's Introductory to Aerospace Engineering course. His research focuses on aerodynamics of small flying devices, especially those where birds and bats coexist in engineering design space. Experiments in wind tunnels include those on simple fixed wings at USC.

AME 105 is meant to introduce freshman engineering students to aerospace engineering principles and concepts. Integrated into the curriculum was an interactive project: measurement of the flight performance of a glider.



<https://spark.adobe.com/page/hEmoUHWAlT50p/>

Reimagining the Interactive Classroom

How two professors in the department of aerospace and mechanical engineering built engaging freshman experiences during a global pandemic



Students added a touch of "humanity" to their experiments, employing special project assistants ranging from human family members to the family dog. PHOTO/Sarah Keough.

Students were shipped materials and carried out the flight performance tests on their own, with guidance from Spedding.

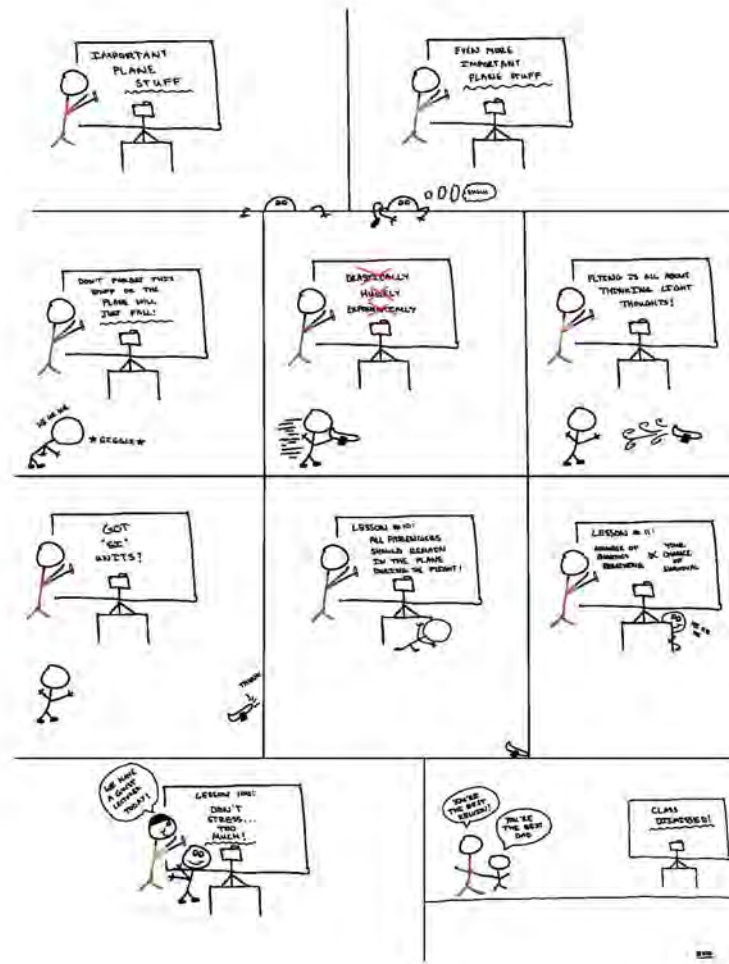
PHOTO/JAI LOONKER.



Reimagining the Interactive Classroom

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Spedding's four-year-old son Kelvin--dubbed "Lord Kelvin"--became a staple of his teaching videos, which he said was part of a "flipped classroom model." Instead of broadcasting or pre-recording long lectures on Zoom, Spedding decided to make bite-sized instructional "nuggets" ranging in two to 10 minutes in length and focusing on one or two key concepts, further digested during interactive discussion sections. The students were able to apply these concepts in their final project and report.



Viterbi student Jared Ramirez drew this comedic representation of class last semester.

Reimagining the Interactive Classroom

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Because remote teaching and remote work in general can sometimes strip away the things we most look forward to as students and teachers--humanity--Spedding found new ways of introducing personality, creativity and fun into the COVID classroom experience. In fact, at the end of the course, he had "Lord Kelvin" invite students to draw images of Spedding and AME 105 in times of COVID. Students drew cartoons, portraits and even created videos--a great creative reprieve for all.



Viterbi student Joseph Fernandez drew a superhero depiction of Lord Kelvin, incorporating the flight-specific focus of AME 105's introductory coursework.

Despite challenges, Ronney said the lessons students learned were invaluable in understanding the modern world of engineering.

"COVID precipitated what was going to happen anyway. We were all headed toward this remote work / remote collaboration environment. It was accelerated by 10 years because of the global pandemic. Students learned to work with a team of people remotely and they did so really well."

Reimagining the Interactive Classroom

How two professors in the department of aerospace and mechanical engineering built engaging freshman experiences during a global pandemic

In the depth of the pandemic, Aerospace Engineering faculty needed to find novel ways to keep their audiences engaged online. Toward that objective, Prof. Paul Ronney, Chair of the Department of Aerospace and Mechanical Engineering (AME) at the University of Southern California, has been using horses as engaging “props.” Here is his “Charge to the AME Graduates” delivered at the virtual graduation ceremony in June 2021.



<https://drive.google.com/file/d/1rNxrZQJ6A3PxLxSvNOsSncW2F1JSVxJh/>

AIAA LA-LV Planetary Defense Workshop (including Hands-on Team Exercises) with Asteroid Exploration Updates (2021 June 26) *(screenshots only)*

<https://engage.aiaa.org/losangeles-lasvegas/viewdocument/june-26-2021-aiaa-la-lv-planetary>

(Also) Artash and Arushi
Nath (STEM K-12 Game
development)

Dr. Nahum Melamed
Project Leader, The
Aerospace Corporation
(Moderator)

Speakers (All Stars!)



Ms. Lianne P. McGinley
Associate Director, Corp.
Comm. & Public Affairs,
Center of Excellence, The
Aerospace Corporation



Ms. Monica Maynard
LA School District STEM
Director; STEM Office, The
Aerospace Corp.



Dr. William H. Ailor
Aerospace Fellow, The
Aerospace Corporation



Dr. Andy Rivkin
Investigation Team Lead, DART
Johns Hopkins Applied Physics
Laboratory



Dr. Paul W. Chodas
Director, Center for Near
Earth Object Studies,
NASA JPL



Mr. W. Randy Bell
Senior Project
Leader, The Aerospace
Corporation



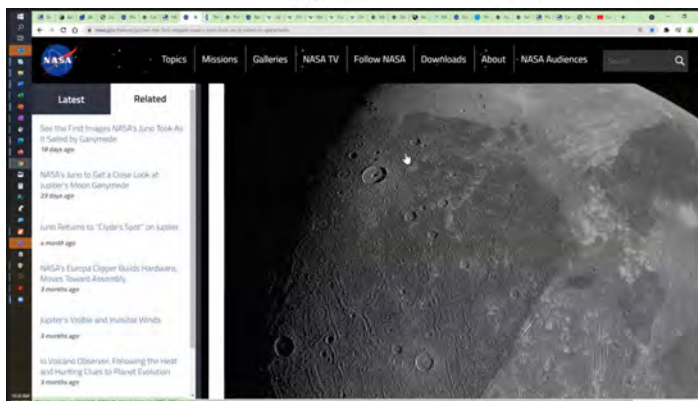
Dr. Joseph A. Nuth III
Deputy Project Scientist
OSIRIS-Rex,
Senior Scientist
NASA's Goddard



Prof. Madhu Thangavelu
Director and Faculty
Member, USC / ISU



Mr. Philip Groves
"Asteroid Hunters"
IMAX Producer &
Writer, Apophis
Pictures, LLC



Dr. Nahum Melamed showing the asteroid impact craters on Ganymede with the very recent images from the Juno Spacecraft, indicating the prevailing similar phenomena and threats everywhere in the Solar Systems. He opened the event and also gave a keynote talk "Asteroid Day Introduction and NEO Deflection App."

Teaming App for Asteroid Deflection
An Aerospace Corporation STEM Outreach Workshop Series

- The Aerospace Corporation has added a collaborative educational context to the App and developed an educational program to conduct asteroid deflection teaming exercises with the NDA
- Several participants are grouped into teams and given an increasingly challenging hypothetical asteroid collision scenario to solve
- The team with the highest performance metric wins the competition
- Aerospace has run 9 virtual and in-person asteroid deflection workshops for teachers, students, and the public to date

The teaming NDA is publicly accessible on Aerospace's website: <https://planetary-defense.aerospace.org/>

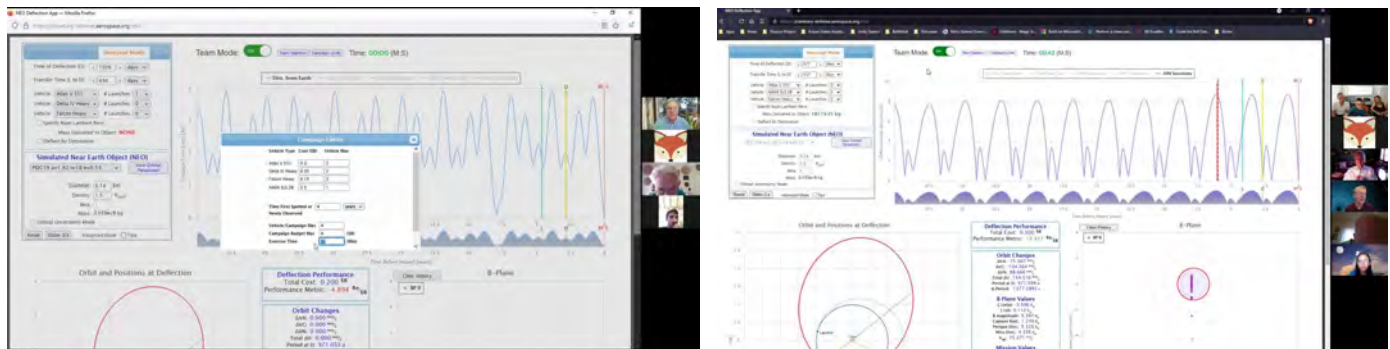


Dr. Melamed, Ms. Lianne McGinley, Ms. Monica Maynard (Aerospace Corp.), and Dr. Paul Chodas (JPL), explaining the NEO Deflection App.

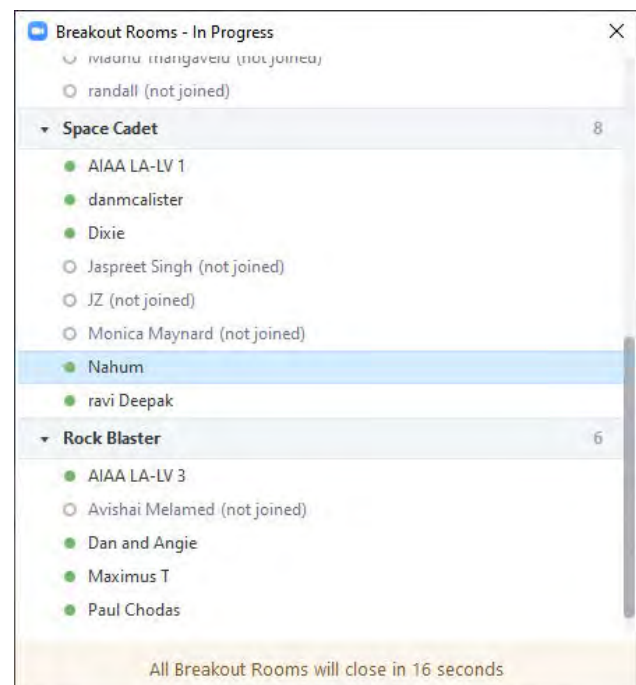
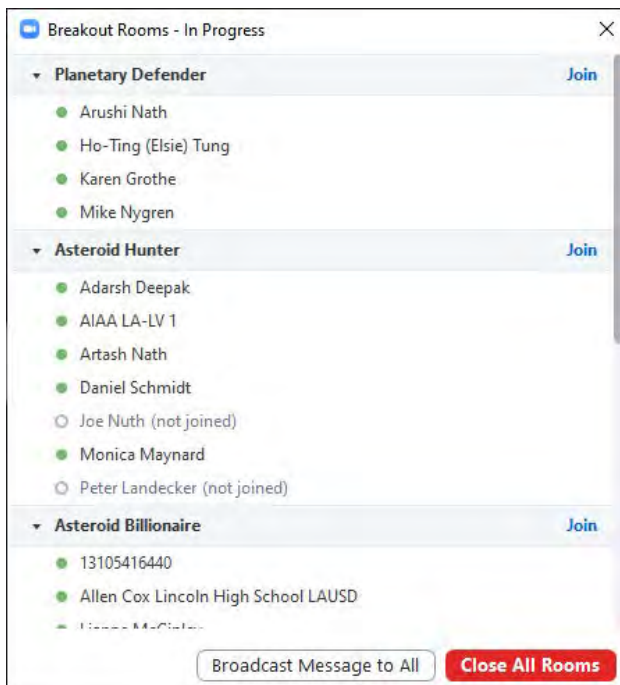
AIAA LA-LV Planetary Defense Workshop (including Hands-on Team Exercises) with Asteroid Exploration Updates (2021 June 26) (screenshots only)



Arushi and Artash Nath, brother and sister, giving a K-12 student talk about the DIY Asteroid Astrometry using Pytheon.



Participants in the Hands-on exercises / workshop were assigned in different teams in different breakout rooms on Zoom, with fun and eye-catching team names (see below), performing the tasks for the given scenarios, using the NEO Deflection App. The instructors went into each of the rooms to guide the members of each team. It was truly fun and and practical, easy to do. Everyone can become the guardian angel / protector of the Earth, and save the Earth / Mankind from the civilization-ending threats ! Together, we can save the Earth, and help developing the related technologies, while enjoying the hands-on sessions.



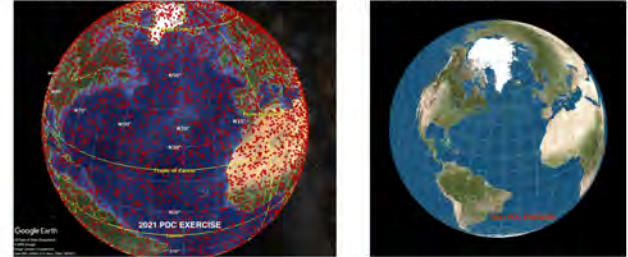
AIAA LA-LV Planetary Defense Workshop (including Hands-on Team Exercises) with Asteroid Exploration Updates (2021 June 26) *(screenshots only)*



After each session, all the team members came out from the breakout rooms and discussed with the instructions about their results and see if they successfully defended the Earth!



Threat Exercise (key inputs from Paul Chodas, Lorien Wheeler, Brent Barbee) see <https://cneos.jpl.nasa.gov/pd/cs/>



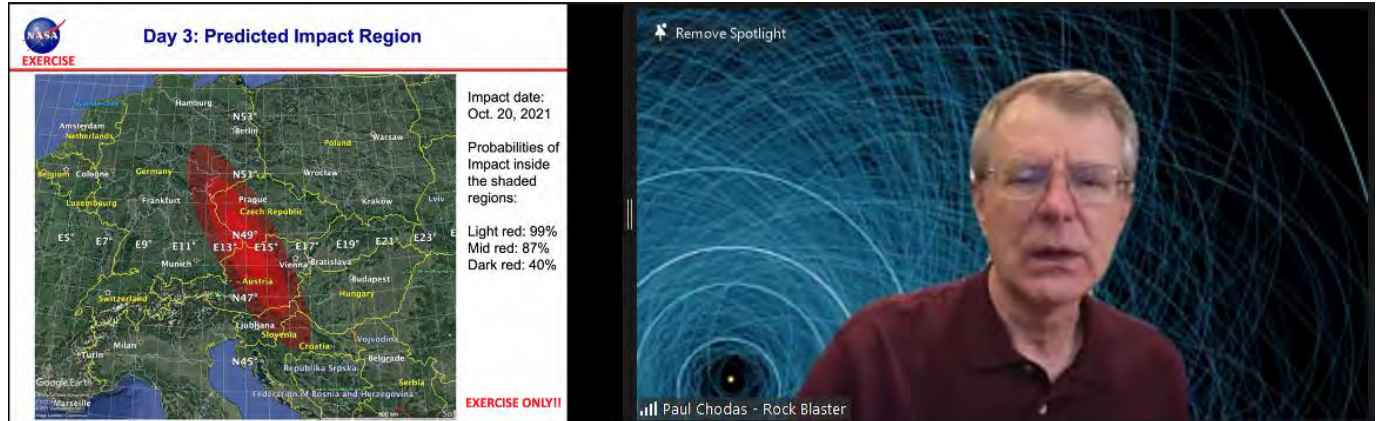
Planetary Defense Conference Series

Dr. Bill Ailor (Aerospace Corp.) dialing in and presenting "History & Overview: Planetary Defense Conference Series" with Threat Exercise.

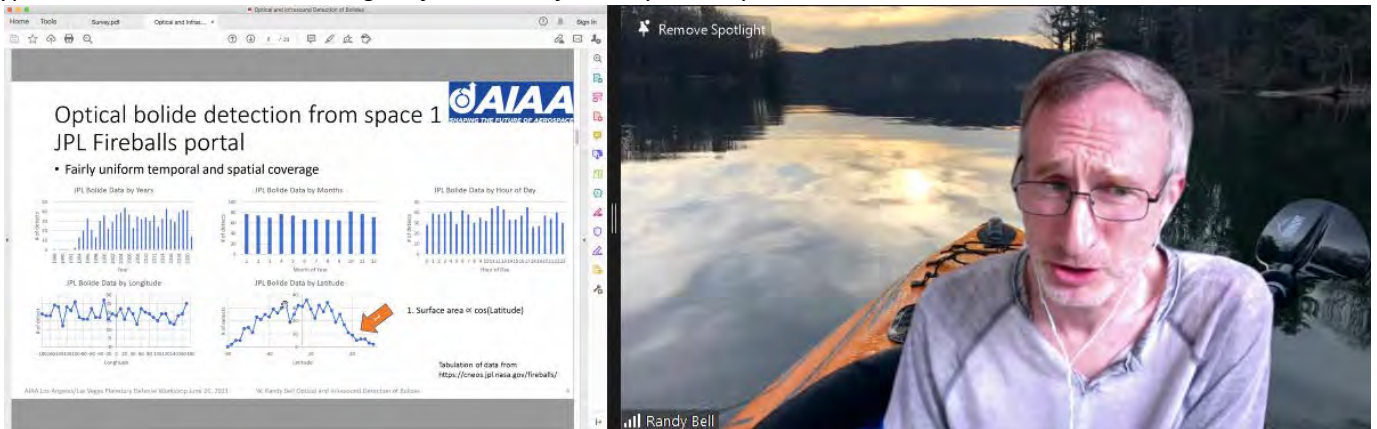


Dr. Andrew Rivkin (Johns Hopkins/NASA-APL) explaining the exciting DART mission, to be launched later this year.

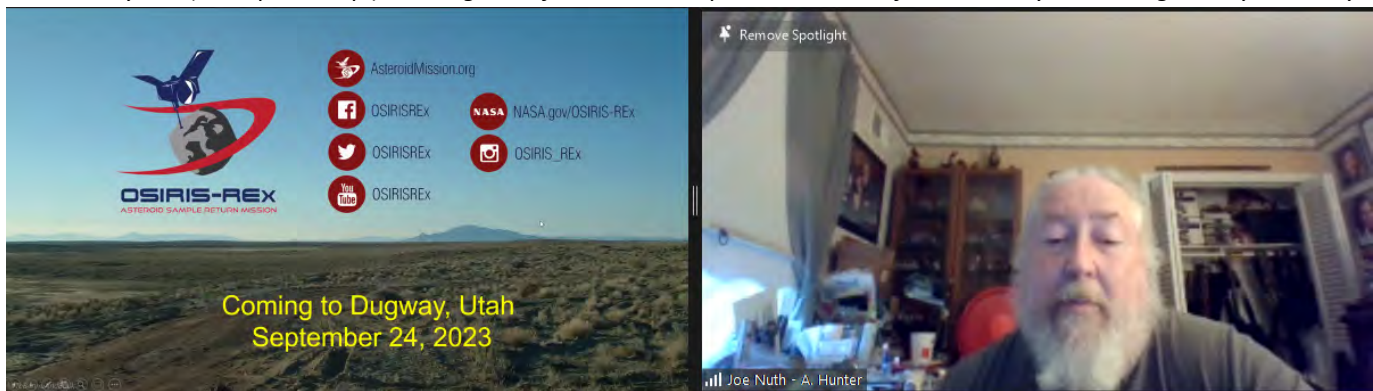
AIAA LA-LV Planetary Defense Workshop (including Hands-on Team Exercises) with Asteroid Exploration Updates (2021 June 26) (screenshots only)



Dr. Paul Chodas (NASA-JPL), reviewing the Planetary Defense Exercises and PDC 2021 Updates, Notable Close Approaches, and Hypothetical Asteroid Scenario designed for the PDC, from Day 1 to Day 3.



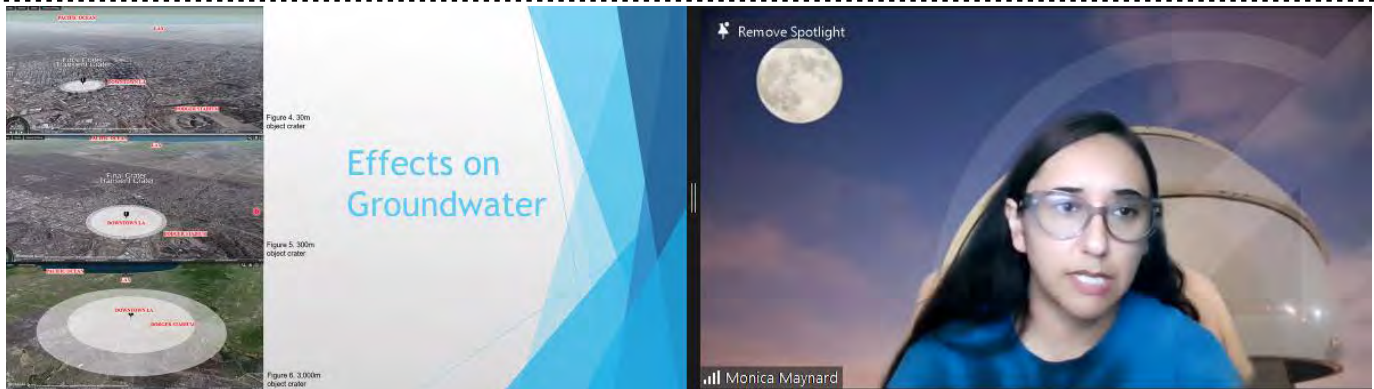
Mr. W. Randy Bell (Aerospace Corp.) showing the Infrasound and Optical detection of Bolides. Very interesting as they are everywhere.



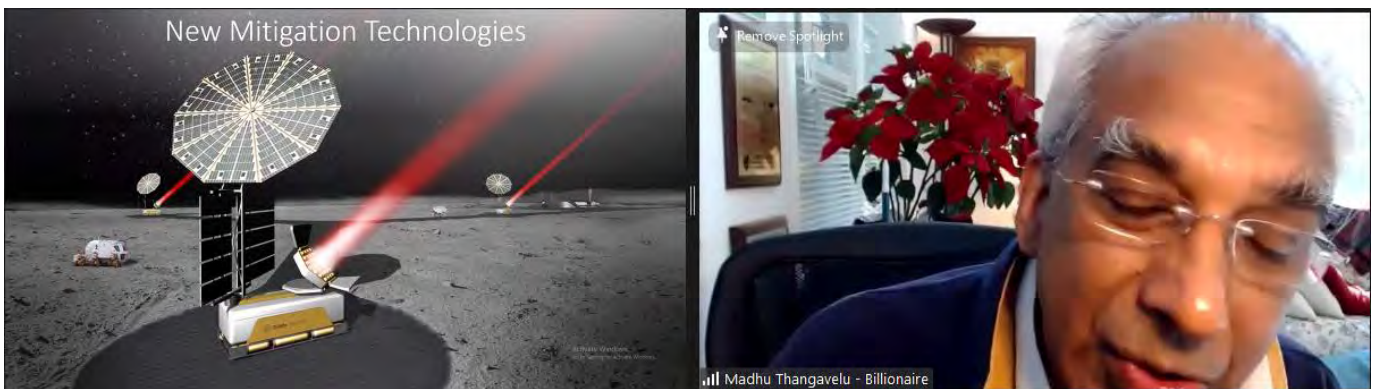
(Upper Left/Right) Dr. Joseph A. Nuth III (NASA's Goddard Space Flight Center) giving updates on the (OSIRIS-REx Mission and Sample Return Mission). The sample return will land somewhere in Dugway, Utah, on September 24, 2023. Very exciting! (Right) Dr. Nuth showing the numbers as of Stow by the OSIRIS-REx on Bennu, including 2 Guinness World Records! Wow! Really great accomplish and good jobs well done.

Numbers as of Stow	
0.11 mm/s smallest maneuver	
126 maneuvers	
363 Bennu orbits	
67,665 images	
482,311 MB data	
1,343,723 commands	
2 Guinness World Records	
1 TAG	
Hundreds of grams of sample	

AIAA LA-LV Planetary Defense Workshop (including Hands-on Team Exercises) with Asteroid Exploration Updates (2021 June 26) (screenshots only)



Ms. Monica Maynard (Aerospace) presenting "How asteroid impacts might affect natural underground water storage and water supply."



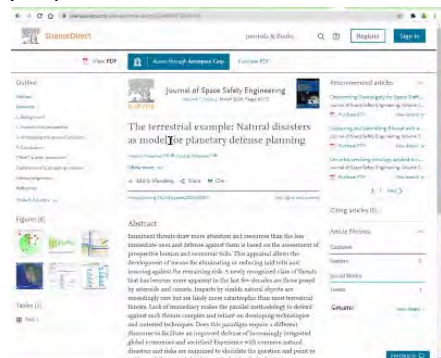
Prof. Madhu Thangavelu (USC) presenting "Evolving Directed Energy System Concepts For Planetary Defense in the Earth-Moon System Domain", highly recommending adding the Moon into the Planetary Defense Systems / Schemes.



Mr. Philip Groves (Apophis Pictures, LLC) presenting "Fostering public support for planetary defense through media", with the Asteroid Hunter IMAX documentary, as well as the Educator Guides he helped compiled. It's very important to outreach to schools.



(Left) Mr. Groves showing some fun news about asteroids in Sci-Fi even before the delightful episodes (2) in Star Trek: The Original. (Right) Dr. Melamed just published a paper together with his son, Mr. Avishai Melamed, about an Planetary Defense model.

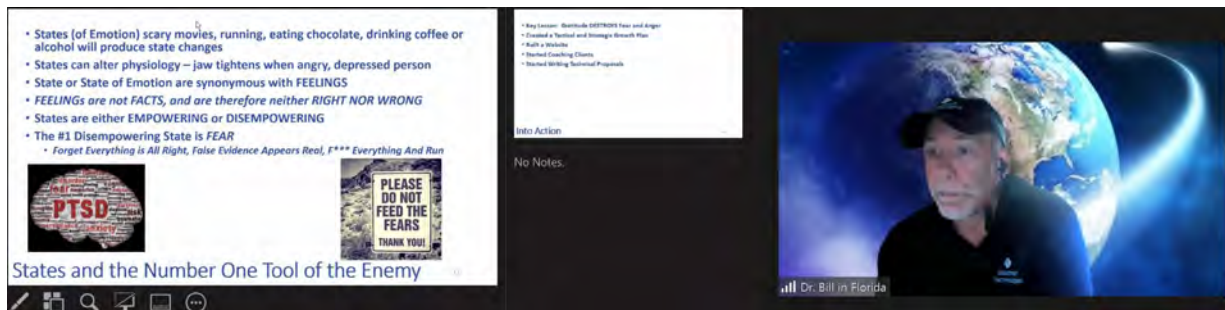


AIAA LA-LV e-Town Hall Section Meeting (2021 July 10) (screenshots only)

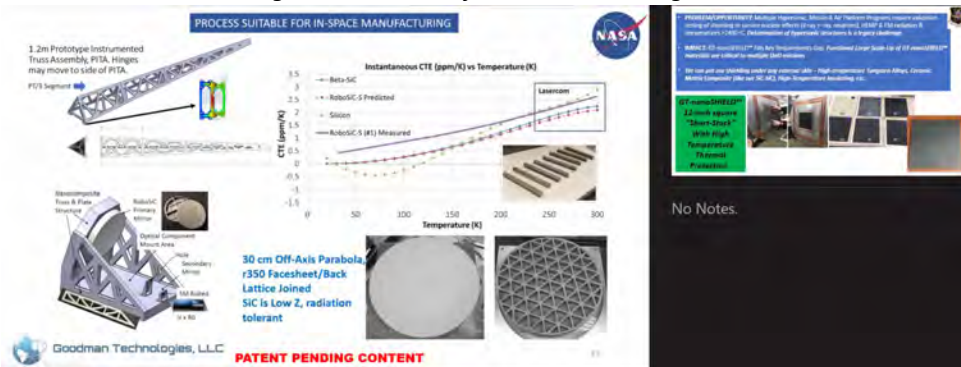
(1) The Psychology for Success in Leadership by Dr. Bill Goodman

(2) Digital Transformation through MBSE - ANSYS technology stack, workflows and use cases by Dr. Swati Saxena

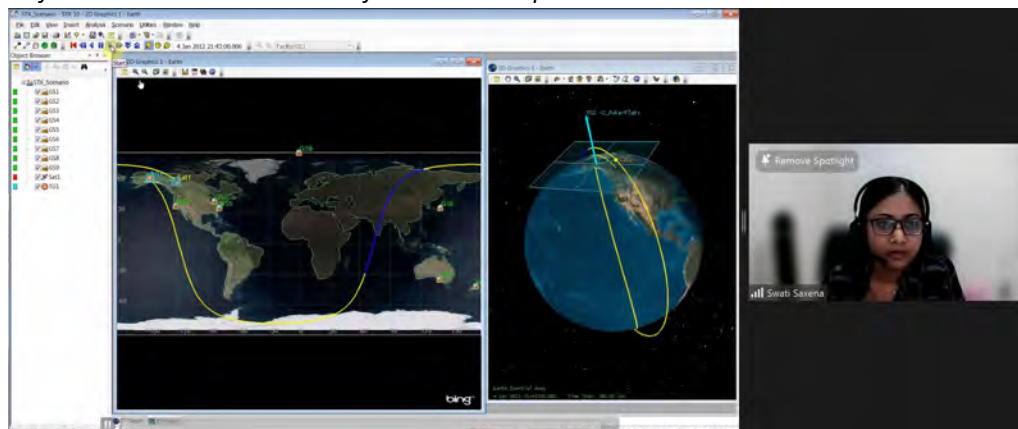
<https://engage.aiaa.org/losangeles-lasvegas/viewdocument/july-10-2021-1-the-psychology>



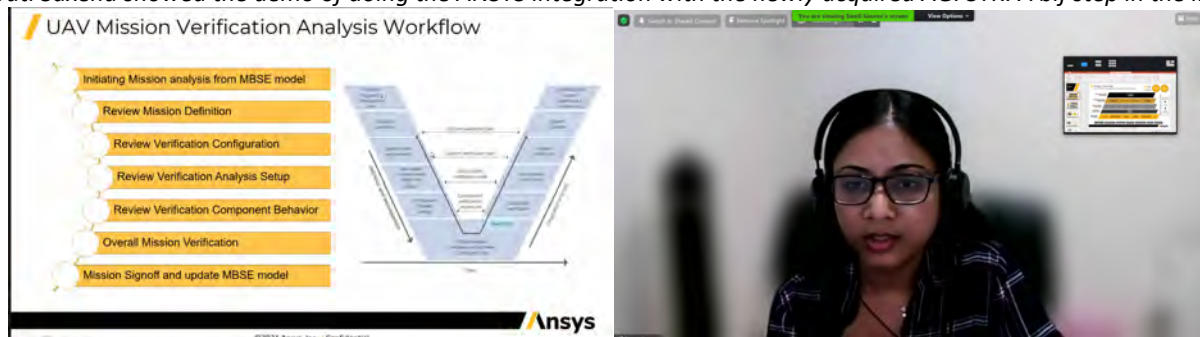
Dr. Bill Goodman shared his experiences how he was very down due to multiple stresses in life and career, including the life-threatening conditions that his son went through and recovered from, and he managed and overcame those stresses.



Dr. Bill Goodman showed what he had been doing for materials in extreme environments / space, and how space and materials have been inspiring him, and how he felt AIAA was like "Star -Trek" for him in aerospace.



Dr. Swati Saxena showed the demo of doing the ANSYS integration with the newly acquired AGI STK. A big step in the industry.



Dr. Swati Saxena explained the importance of acquiring Phoenix Integration recently, and the MBSE process in the ANSYS systems integration.

e-Happy Hour on AIAA LA-LV Virtual Moon Base Alpha, Clavius Crater, the Moon (2021 July 20) *(screenshots only)*

(Event Information) http://events.r20.constantcontact.com/register/event?oeidk_a07ei7350v144e3bc6d&llr_p9tbt6cab

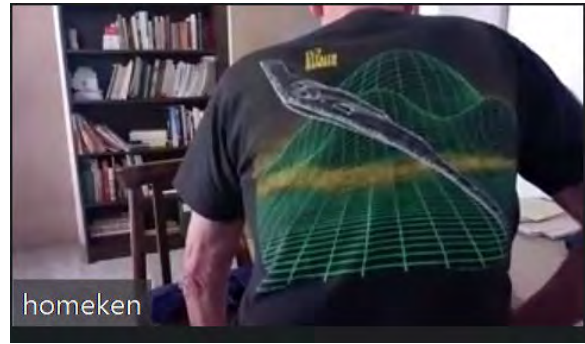
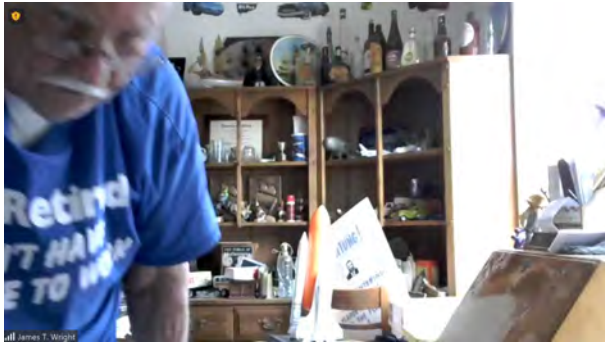


After a while into the event and touring around the virtual Moon Base Alpha of AIAA LA-LV on the Clavius Crater, the Moon, some people gradually converged in the main deck and chatted about many exciting things, from Richard Branson / Virgin Galactic's SpaceShipTwo Unity 22 flight on July 11, Jeff Bezos flight on Blue Origin's New Shepard on July 20, exciting stories about the Apollo 11 Moon Landing, Saturn V, Sci-Fi like 2001 Space Odyssey, Sapce 1999, lave tubes, future missions like Artemis and habitats etc. Very delightful and enjoyable eveving.



Maximus, the inspiring and intelligent middle school student, volunteered to designed the virtual meeting space for the next AIAA LA-LV e-Happy Hour, with the Star Trek Enterprise as the theme. Please join us, have fun, and appreciate the design !

AIAA LA-LV Aero Alumni Meeting (2021 July 21) (screenshots only)



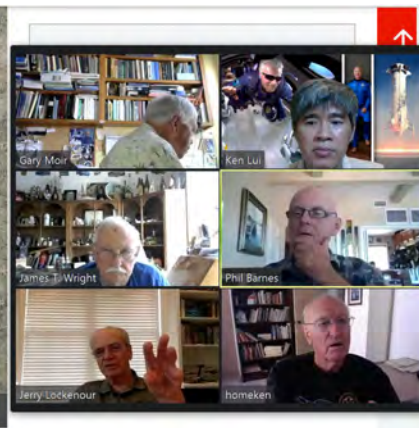
(Left) Mr. James T. Wright repositioned his model of the Space Shuttle and the booster and showed it to the attendees. (Right) Dr. Ken Saunders showed the backside printing of the B-2 T-shirt he bought a few years ago. Very enthusiastic!



The meeting participants were very enthusiastic about the Jul 11 and July 20 flights by Virginia Galactic and the Blue Origin, discussing some details like the crew, pilots, passengers, space, apogees, the Karman Line, Launching site, landing sites, and the physics calculations etc.



The launch and landing sites are at a secretive location in the middle of the desert
Credit: Google Maps



(Left) The meeting participants were discussing and calculation the distances and capsule velocity of the July 20 Blue Origin new Shepard flight, though the information was limited, likely due to the secretive location as indicated in the news.

(Right) The participants discussed and examined the crash of B-2 many years ago, while Dr. Ken Saunders showed people the front of his B-2 t-shirt.

The aircraft was destroyed, a total loss estimated at US\$1.4 billion

According to the Air Force Times, which is a private-industry magazine, no munitions were on board.

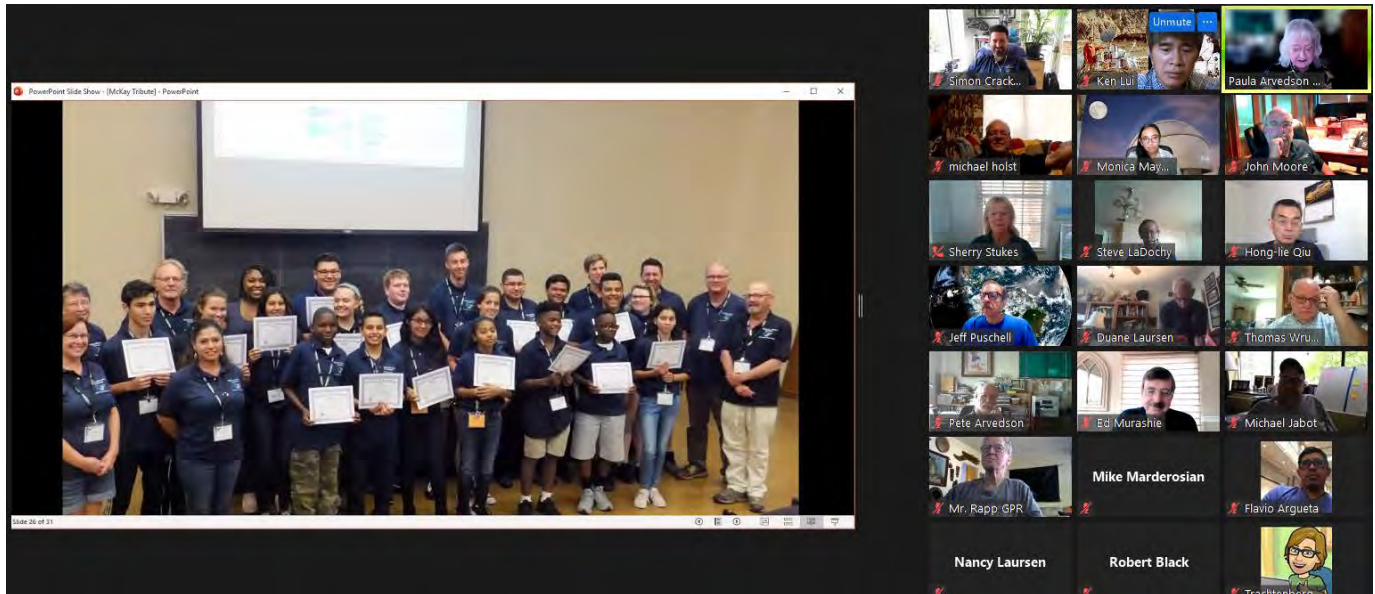


Investigation details:

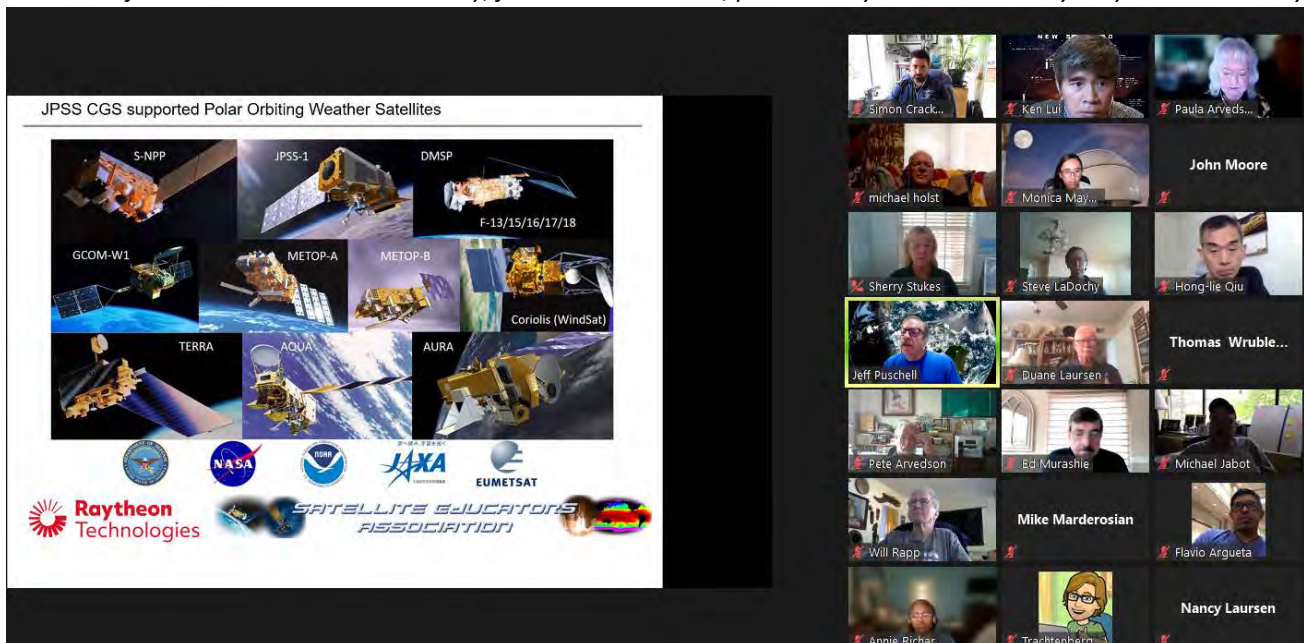
The findings of the investigation stated that the B-2 crashed after "heavy, lashing rains" caused moisture



AIAA LA-LV Virtual Exhibition in the Satellite& Education Conference XXXIV (2021 July 24) (screenshots only)



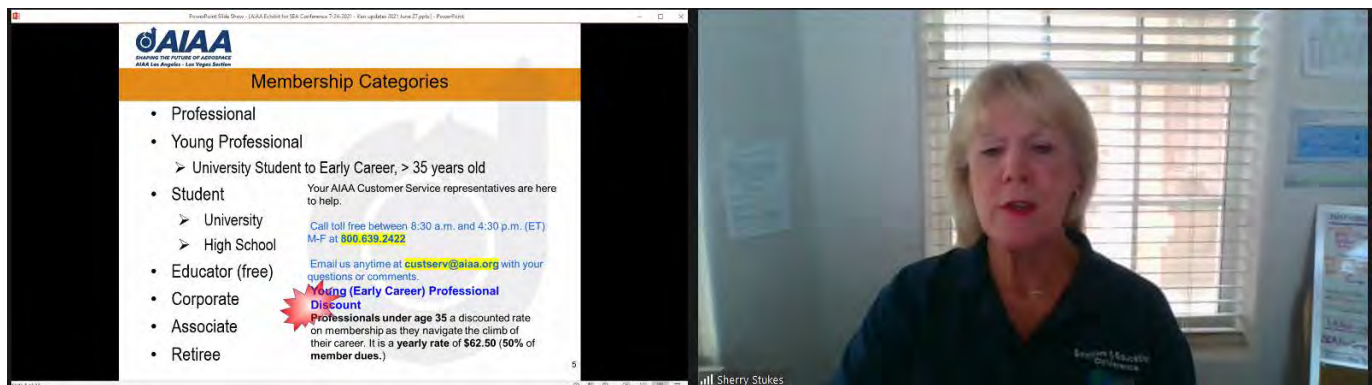
Prof. Paula Arvedson opened the event and reviewed the histories & highlights of SEA, the SEA Conferences, and M.Y.S.P.A.C.E. She mentioned the unfortunate news that Mark McKay, former SEA President, passed away in 2020. Dr. Cheryl Ney welcomed everyone.



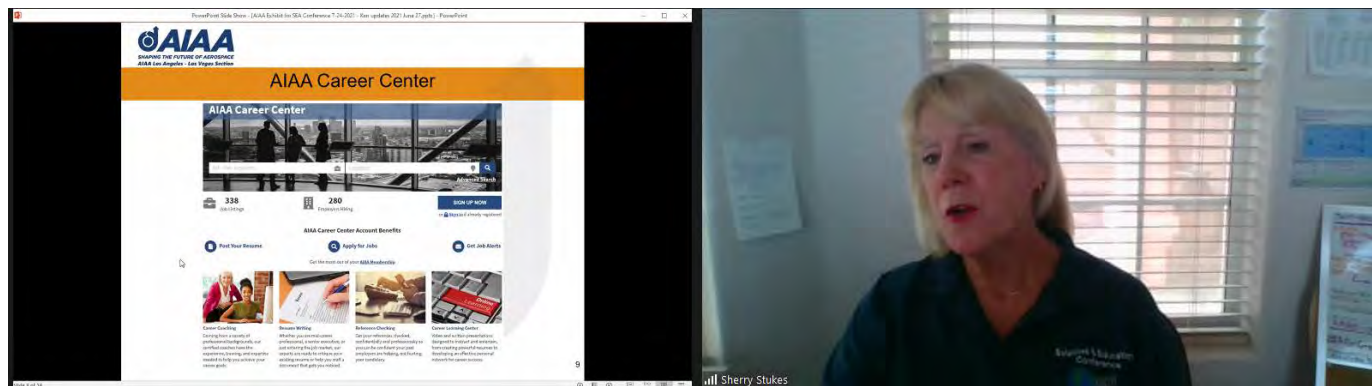
Dr. Jeff Puschell (Raytheon PI & Fellow, Section Chair of AIAA LA-LV Section, Vice Chair of the SEA) gave the inspiring keynote speech about the weather sciences/satellites. He briefly mentioned the JPS CGS supported Polar Orbiting Weather Satellites. (Below) Dr. Puschell showed the interesting satellite images of hurricanes (and the interesting shape similarities with the spiral galaxies.).



AIAA LA-LV Virtual Exhibition in the Satellite& Education Conference XXXIV (2021 July 24) (screenshots only)



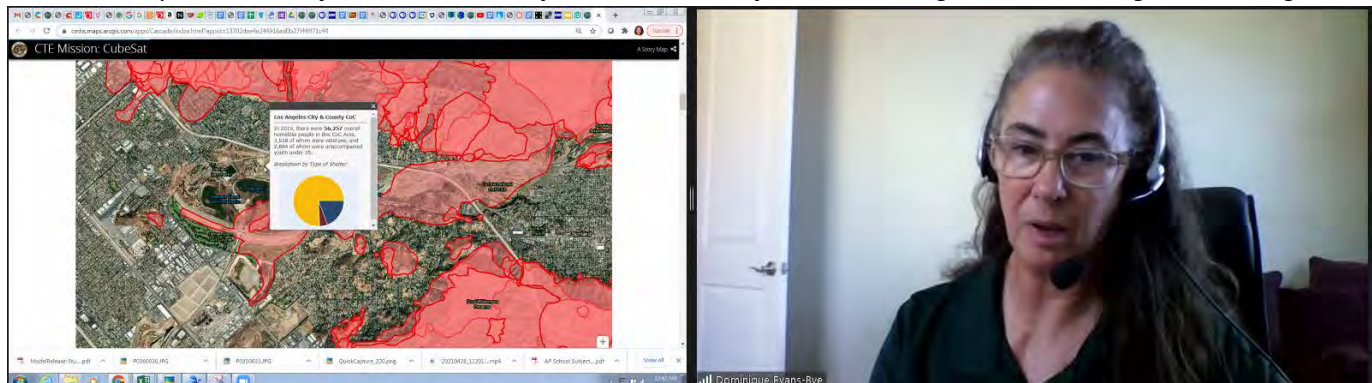
Ms. Sherry Stukes (NASA JPL, AIAA Member) exhibited online for the AIAA LA-LV Section, showing the AIAA Membership and benefits.



Ms. Stukes also talked about the great advantages of becoming an AIAA Member, including, but not limited to, the Career Center.

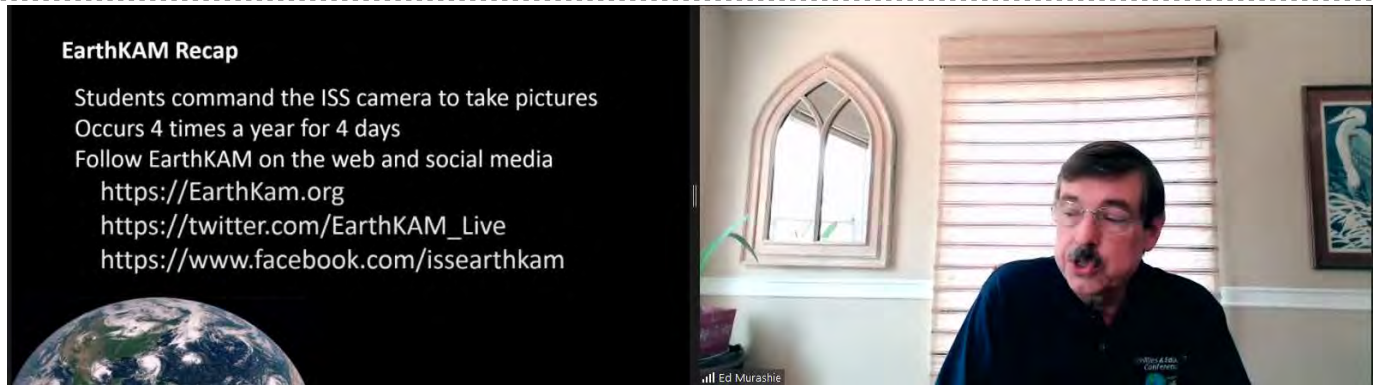


Ms. Kelley Le, Director of the UCI Science Project & Co-Founder of RRISE UP, taking on Climate Change with Courage.

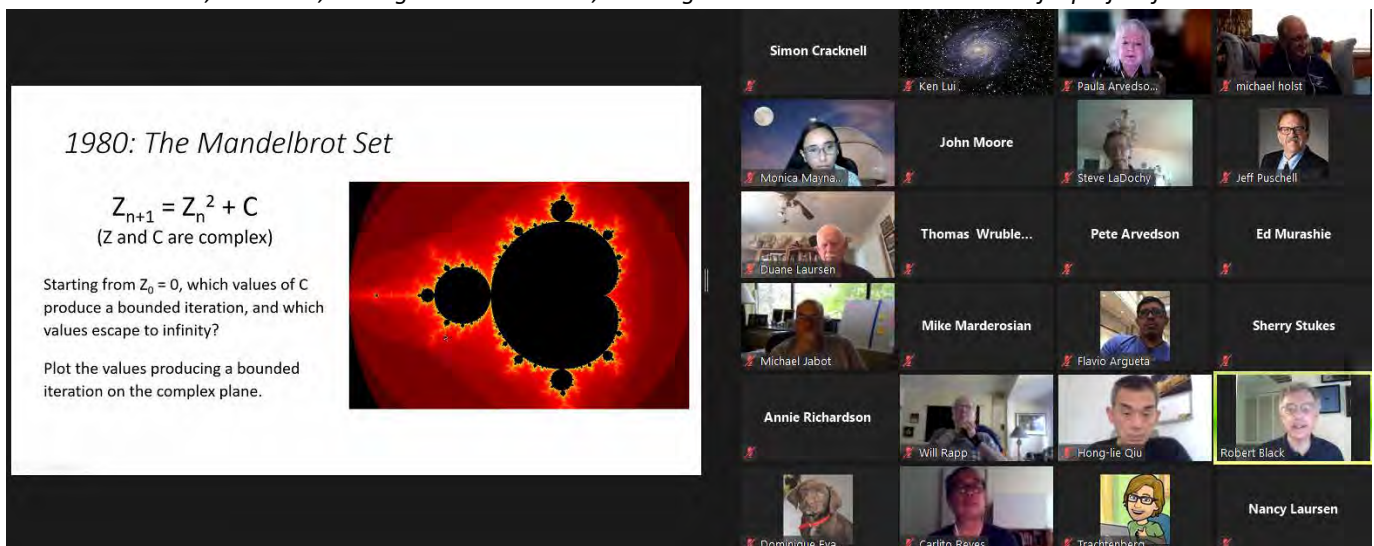


Ms. Dominique Evans-Bye, and students Clark Magnet High School, CTE Mission: taking about student CubeSat in K-12 education.

AIAA LA-LV Virtual Exhibition in the Satellite& Education Conference XXXIV (2021 July 24) (screenshots only)

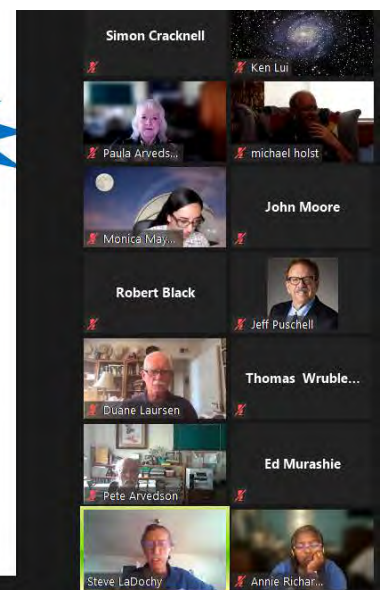


Mr. Ed Murashie, President, ProEngineered Solutions, showing the EarthKam: The Ultimate Selfie project for K-12 education.



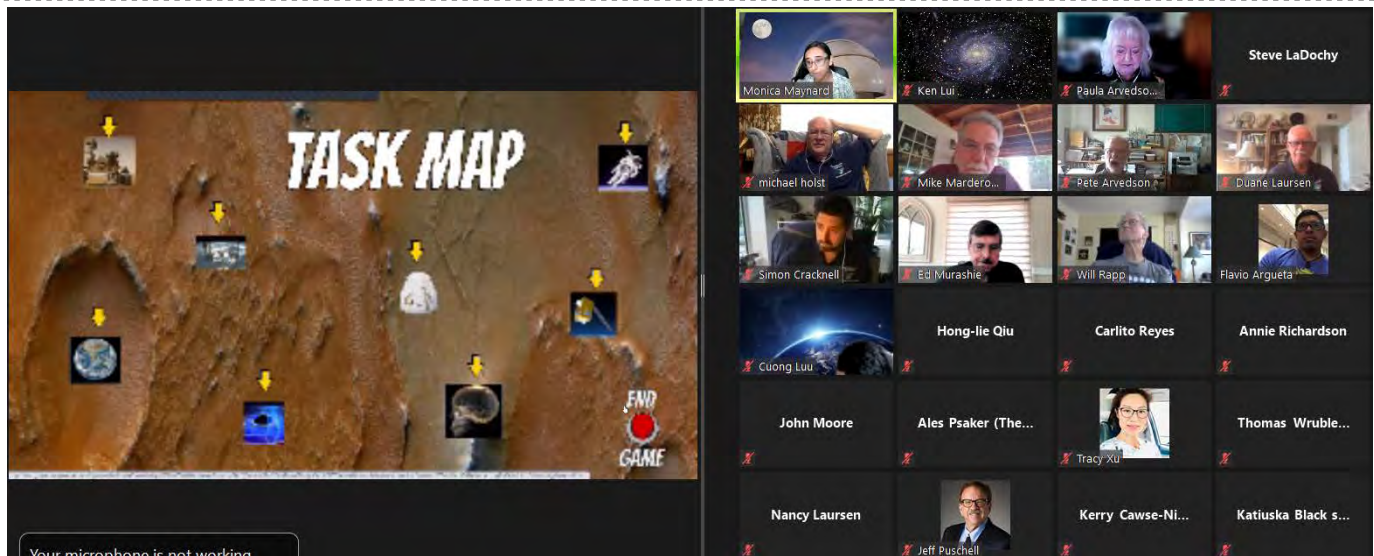
Mr. Robert A. Black, Author, Royal Fireworks Publishing, presenting "Bottomless Wonders from Simple Rules", and the beauty / important of the fractals/chaos, along with the mathematician behind those.

Competitive Grant-funded Summer Courses

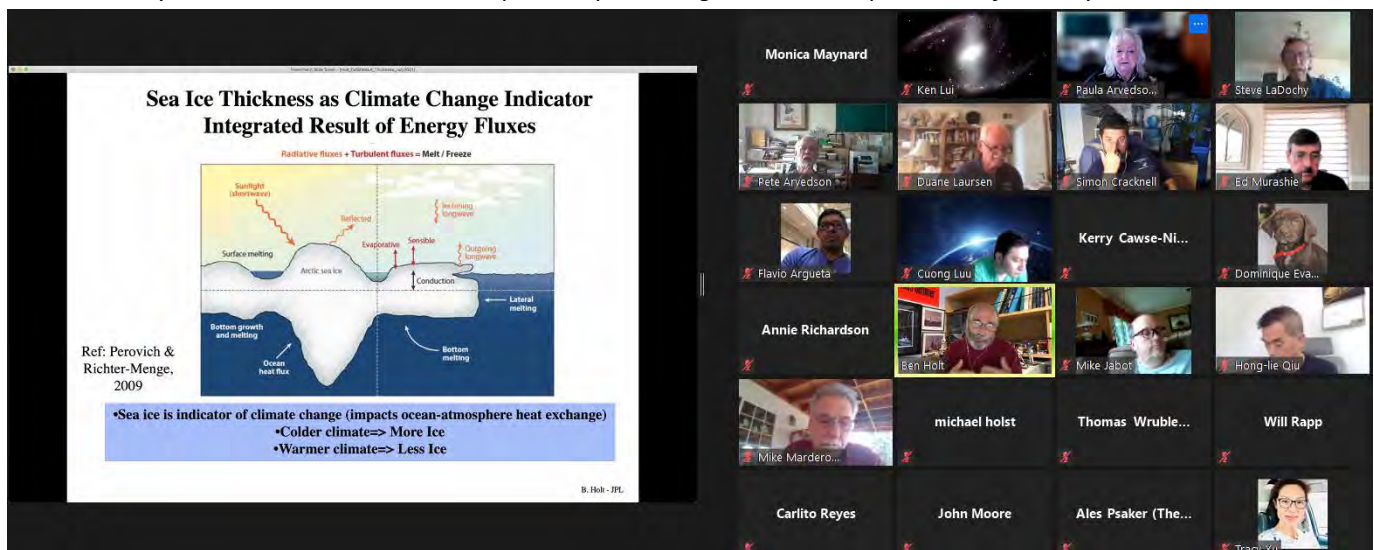


Prof. Steve LaDochy, talking about the American Meteorological Society, and the fun & interesting projects for K-12 education.

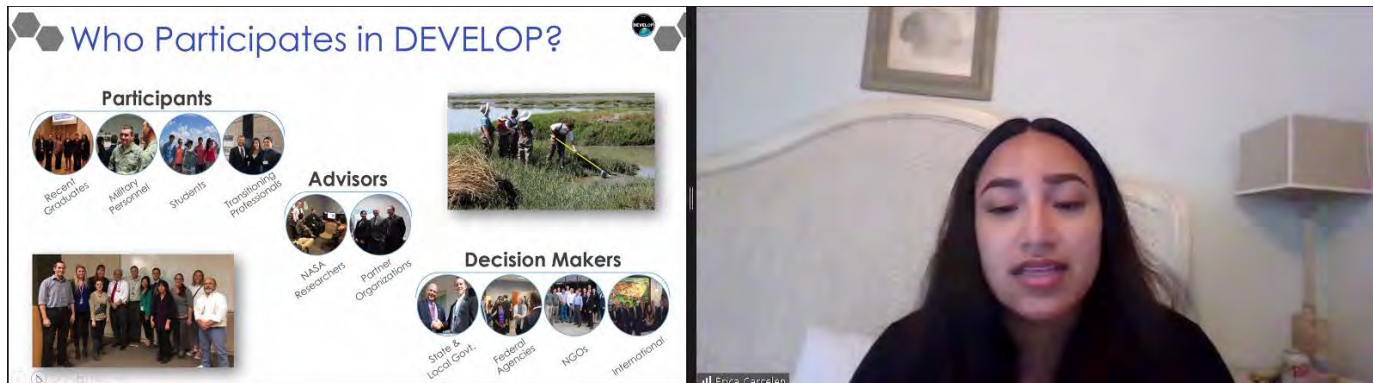
AIAA LA-LV Virtual Exhibition in the Satellite& Education Conference XXXIV (2021 July 24) (screenshots only)



Ms. Monica Maynard, STEM Coordinator, Aerospace Corp, showing the Mars Escape Room software by a demo with the attendees.



Mr. Ben Holt, NASA, giving the afternoon keynote on Observing Arctic Ocean Sea Ice Thickness.

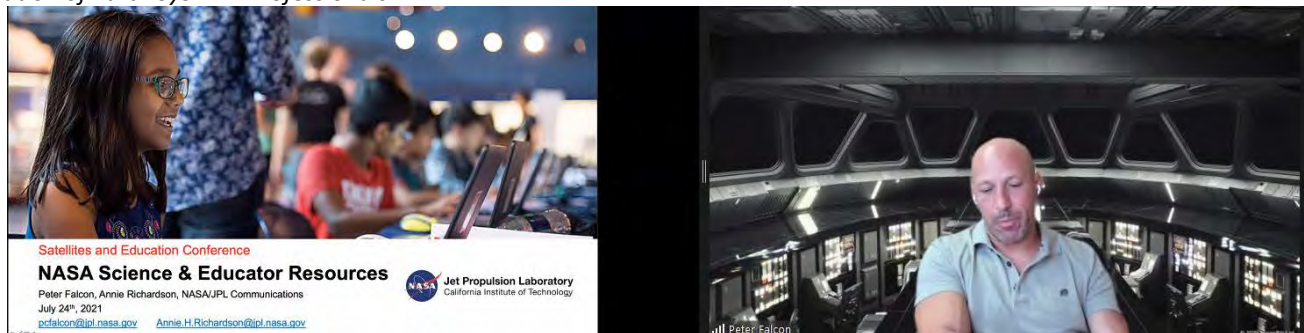


Ms. Erica Carcelen (Geoinformatics Fellow, JPL Lead) talking about NASA DEVELOP, and who are the participants in DEVELOP.

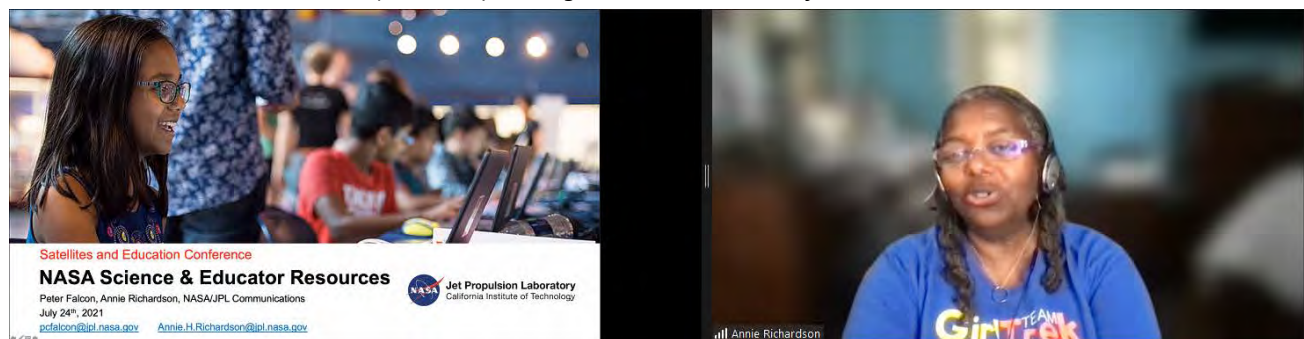
AIAA LA-LV Virtual Exhibition in the Satellite& Education Conference XXXIV (2021 July 24) (screenshots only)



Mr. John Moore, Executive Director, Institute for Earth Observations, New Jersey, talking about the A³ Sat: Engaging the Next Generation of Earth SYSTEM Professionals.



Mr. Peter Falcon (NASA JPL), talking about the Resources for K-12 Education in NASA/JPL .

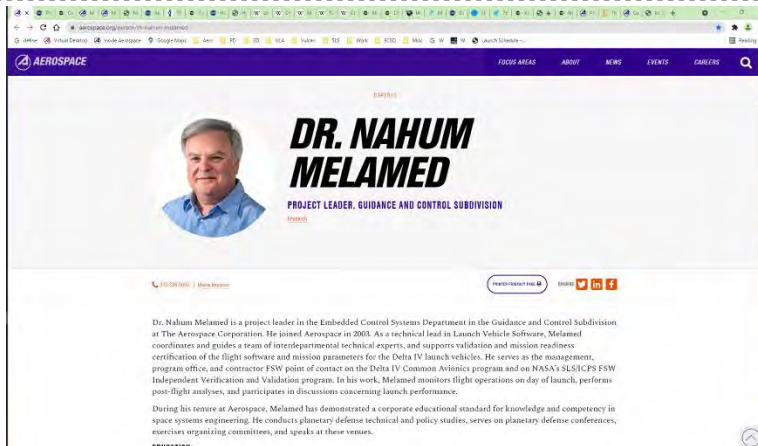


Ms. Annie Richardson (NASA/ JPL Earth Science Outreach) sharing her passion for the K-12 education outreach, which was why she came back from retirement and devoted herself in what she enjoyed doing the most - SEA Conference and K-12 Outreach.

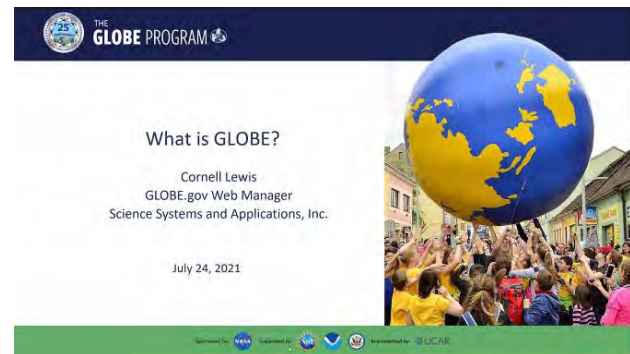
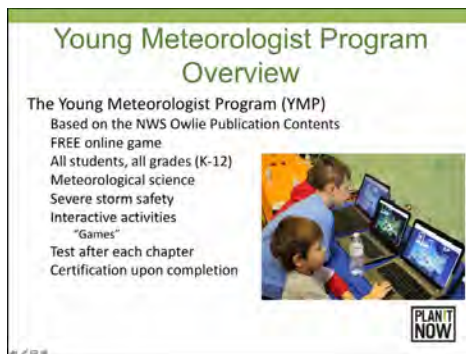


Ms. Eve Terrill talking about the Mosquito Habitat Mapper as a great way to inspire K-12 students.

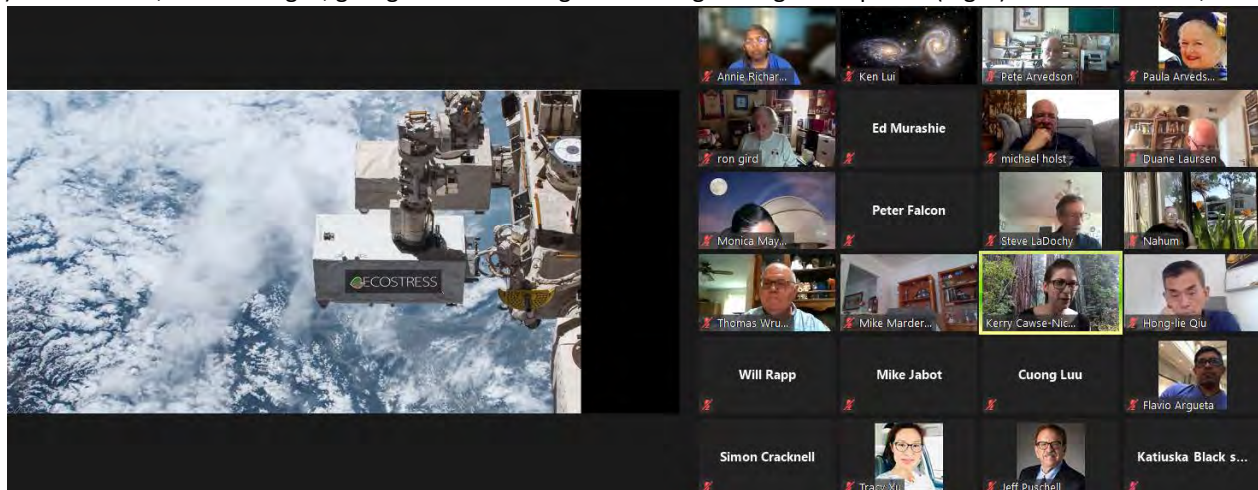
AIAA LA-LV Virtual Exhibition in the Satellite& Education Conference XXXIV (2021 July 24) (screenshots only)



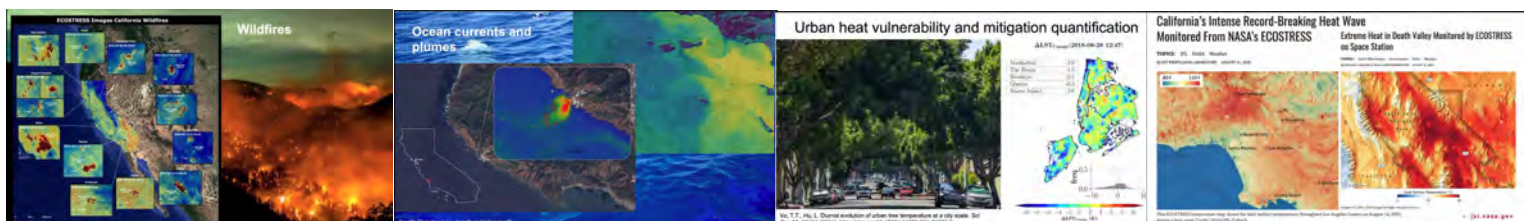
Dr. Nahum Melamed, Project Leader, Aerospace Corp, presenting "Move an Asteroid, Shape the Future"



(Left) Mr. Ron Gird, Meteorologist, giving the "The Young Meteorologist Program" update. (Right) Mr. Cornell Lewis, SSAI, on GLOBE .



Dr. Kerry Cawse-Nicholson, NASA/JPL Deputy Science Lead, talking about ECOSTRESS - a Thermal Radiometer Mounted on the International Space Station, and the heat, drought, trees, wildfires, ocean currents and plumes, Urban heat vulnerability and mitigation quantification, and the California's Intense Record-Breaking Heat Waves Monitoring etc.



A satellite's impending fiery demise shows how important it is to keep space clean

by Samantha Masunaga, Los Angeles Times on 2021 June 29

<https://www.arcamax.com/currentnews/newsheadlines/s-2535425>



From left to right: Patrick Kelly, DRAGRACER Program Manager, Ian Silverberg, 2021 Astrodynamics and Analysis Intern and Tyler Ritz, Optical Communications Engineer, attempt to locate the DRAGRACER satellite during a break in the clouds in Joshua Tree on Wednesday, June 23, 2021 in Joshua Tree, CA..

LOS ANGELES — Space is vast. But the area around our planet is getting crowded.

New technologies and the proliferation of competing rocket companies have made it cheaper to reach low Earth orbit. But more objects in space can also mean more spacecraft-damaging collisions. That could jeopardize satellites that connect rural and underserved areas with broadband, as well as those that take images that help farmers track their crops' health. It even could endanger the International Space Station, its astronauts and research aboard that could fuel cancer treatments and the creation of organs for transplant.

A too-cluttered sky could also get in astronomers' way of learning more about the cosmos. And surrounding Earth with a continually denser layer of outmoded junk means that eventually there wouldn't be room for the new, useful satellites of the future.

That's why three engineers were out in Joshua Tree in the middle of the night last week. They're part of a team exploring a possible solution: a device that would help satellite owners clean up after themselves.

Their goal that night? To track the impending fiery demise of a small satellite.

Alchemy — the name of the satellite soon to face its doom — was built by El Segundo-based Millennium Space Systems, a division of Boeing Co., to test a technology that would help drag spacecraft lower into the atmosphere to burn up after the craft's mission is complete.

Alchemy was launched in November with its twin, Augury, which will serve as the control, demonstrating how much longer Alchemy would hang around as space junk without the new tech dragging it further down into the atmosphere. The program running this experiment has a tongue-in-cheek name: Dragracer.

"It's definitely an appropriate name," said Patrick Kelly, the Dragracer program manager. "They're racing back to Earth. One has a very clear advantage over the other."

Currently, long-dead satellites, spent rocket bodies and other pieces of outdated spacecraft float in orbit for years. There are about 23,000 pieces of space debris larger than a softball circling the planet, according to NASA. Objects that are too small to be tracked also pose a threat. NASA estimates there are 500,000 marble-sized pieces of junk in Earth's orbit, along with more than 100 million that are 1 millimeter or smaller.

Joining that party are hordes of new satellites. Companies such as SpaceX and OneWeb have started launching satellites to low Earth orbit for broadband internet networks that are meant to provide connectivity worldwide, especially in areas that can't be easily reached with fiber cables or cell towers. When complete, OneWeb's "constellation" is set to comprise more than 600 satellites. SpaceX's will be made of thousands.

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A satellite's impending fiery demise shows how important it is to keep space clean



Patrick Kelly, DRAGRACER Program Manager, points to the Alchemy DRAGRACER satellite which appears as a moving round dot on the screen on Wednesday, June 23, 2021.

"The rate at which we're launching is increasing exponentially and is proposed to increase five- to tenfold over the coming decade," said Timiebi Aganaba, an assistant professor at Arizona State University's School for the Future of Innovation in Society. "We don't want to raise alarm by saying it's so, so terrible, but the thing is, it potentially could be so, so terrible if we don't do anything about ensuring that people think more sustainably about how to do space activities."

More space junk means the potential for more collisions, which in turn create more junk. Already, the International Space Station has had to maneuver itself to avoid debris 29 times since 1999, including three times last year alone. Even tiny objects can be a huge problem — space shuttle windows have had to be replaced because of damage caused by paint flecks whizzing through space and hitting them.

Astronomers fear the clutter could hurt optical astronomy and the cultural relationship people have with dark skies. Countries that dream of launching spacecraft for the first time may not have room to operate.

And there are now questions about whether space should be considered a human environment and thus subject to environmental laws.

The discussion becomes especially pertinent as the space industry discusses whether humans could — or should — become a multiplanetary species and how to establish other permanent space settlements. Already, some humans have lived in space since 2000 — the beginning of a 21-year uninterrupted streak of human inhabitation of the space station.

"We need to start thinking sustainably from Day 1 to ensure activities can continue in the long term," Aganaba said.

One option is to ensure spacecraft remove themselves from orbit. The Dragracer program's Alchemy satellite is testing the efficacy of Terminator Tape, a box about the size of a DVD case that contains more than 220 feet of a folded-up film with an aluminum coating. One end of the film is attached to the inside of the box, the other end is attached to the box's lid, and the box is connected to the satellite.

When the satellite stops being useful, it's the box's time to shine. Activated either by a person on the ground or by a timer, a release mechanism kicks out the box lid, unfurling the film. The film creates extra drag on the satellite, which accelerates the craft's fiery return into the atmosphere.

The drag comes partly from the way the conductive film interacts with the Earth's magnetic field and with plasma in the ionosphere, creating an electrodynamic force, said Rob Hoyt, founder and president of Tethers Unlimited, which makes the device. It also results from the satellite and film's interaction with the particles of the thin, upper layers of Earth's atmosphere.

The Alchemy satellite is expected to burn up as early as July, less than eight months after launch. The Augury satellite, which lacks the tape, is expected to stay in orbit for at least seven years.

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A satellite's impending fiery demise shows how important it is to keep space clean



(Left) Millennium Space Systems' Ian Silverberg, left, Tyler Ritz and Patrick Kelly visit Joshua Tree to try to catch a glimpse of a satellite that's testing a way to keep space junk from proliferating in space.

(Right) Patrick Kelly adjusts the telescope in Joshua Tree to try to view the Dragracer satellites, which are testing a way to remove junk from space.



Back in Joshua Tree, the engineers from Millennium Space Systems begin assembling their telescope to watch the progressing deorbit of the Alchemy satellite. They've done most of their observations from the parking lot of the company's El Segundo headquarters and have collected a lot of data despite the light pollution and clouds in the area, Kelly said. But the desert has better visibility.

"It's night and day," he said. "We've been able to capture both Dragracer units with the sunlight glinting off it from this location. That's just been really great."

The team has been to this spot in Joshua Tree a few previous times and was able to see how much the Alchemy satellite has plummeted compared with the unchanging Augury. There's usually been a good pass of the satellite between 2 a.m. and 4 a.m. The telescope is calibrated with whatever stars are visible in the sky — a challenge when there's so much cloud cover, as there is on this weekday night.

"This tends to happen," Kelly says. "We've got time before the actual pass."

By 2:30 a.m., raindrops are plopping louder and harder. Tyler Ritz, an optical communications engineer, pulls out a golf umbrella and holds it over the telescope, while Kelly and intern Ian Silverberg cover the telescope with a parachute blanket.

By 3:15 a.m., the wind has picked up and the sky overhead is very cloudy. The team calls it at 3:45 a.m. and starts to pack up the telescope.

The impending demise of the Alchemy satellite will be "bittersweet," Kelly says, particularly since he's been there from the concept stage all the way until this satellite's end. (The team will actively track the Augury satellite until this autumn to get a full year's worth of data.)

"It'll be really exciting to get that validation and confirmation to see how well the experiment worked out," he said. "At the same time, it's going to be a little sad to let it go and know that some of that excitement is coming to an end."

There are other ways to deorbit satellites — such as thrusters that would guide the satellite further into the atmosphere at the end of its life — but the Terminator Tape used for the Dragracer satellites is intended to be cheaper and simpler, Hoyt said. (The device's name is indeed inspired by the Terminator movie franchise.) So far, Terminator Tape units delivered have cost between \$50,000 and \$100,000, though Hoyt said future versions will cost less.

"We're really trying to minimize the cost of ensuring that satellites get disposed of safely," he said.

That disposal will be crucial for humanity's next steps in space.

"As we gain more access to space," Kelly said, "we're putting more and more objects up there, so it's becoming really important to make sure we're using it intelligently and thoughtfully and not preventing ourselves from accessing it in the future."

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NASA's Webb Will Use Quasars to Unlock the Secrets of the Early Universe

2021 June 23

<https://www.nasa.gov/feature/goddard/2021/nasa-s-webb-will-use-quasars-to-unlock-the-secrets-of-the-early-universe>

Quasars are very bright, distant and active supermassive black holes that are millions to billions of times the mass of the Sun. Typically located at the centers of galaxies, they feed on infalling matter and unleash fantastic torrents of radiation. Among the brightest objects in the universe, a quasar's light outshines that of all the stars in its host galaxy combined, and its jets and winds shape the galaxy in which it resides.



This is an artist's concept of a galaxy with a brilliant quasar at its center. A quasar is a very bright, distant and active supermassive black hole that is millions to billions of times the mass of the Sun. Among the brightest objects in the universe, a quasar's light outshines that of all the stars in its host galaxy combined. Quasars feed on infalling matter and unleash torrents of winds and radiation, shaping the galaxies in which they reside. Using the unique capabilities of Webb, scientists will study six of the most distant and luminous quasars in the universe.

Credits: NASA, ESA and J. Olmsted (STScI)

Shortly after its launch later this year, a team of scientists will train NASA's James Webb Space Telescope on six of the most distant and luminous quasars. They will study the properties of these quasars and their host galaxies, and how they are interconnected during the first stages of galaxy evolution in the very early universe. The team will also use the quasars to examine the gas in the space between galaxies, particularly during the period of cosmic reionization, which ended when the universe was very young. They will accomplish this using Webb's extreme sensitivity to low levels of light and its superb angular resolution.

Webb: Visiting the Young Universe

As Webb peers deep into the universe, it will actually look back in time. Light from these distant quasars began its journey to Webb when the universe was very young and took billions of years to arrive. We will see things as they were long ago, not as they are today.

NASA's Webb Will Use Quasars to Unlock the Secrets of the Early Universe

“All these quasars we are studying existed very early, when the universe was less than 800 million years old, or less than 6 percent of its current age. So these observations give us the opportunity to study galaxy evolution and supermassive black hole formation and evolution at these very early times,” explained team member Santiago Arribas, a research professor at the Department of Astrophysics of the Center for Astrobiology in Madrid, Spain. Arribas is also a member of Webb's Near-Infrared Spectrograph (NIRSpec) Instrument Science Team.

The light from these very distant objects has been stretched by the expansion of space. This is known as cosmological redshift. The farther the light has to travel, the more it is redshifted. In fact, the visible light emitted at the early universe is stretched so dramatically that it is shifted out into the infrared when it arrives to us. With its suite of infrared-tuned instruments, Webb is uniquely suited to studying this kind of light.

Studying Quasars, Their Host Galaxies and Environments, and Their Powerful Outflows

The quasars the team will study are not only among the most distant in the universe, but also among the brightest. These quasars typically have the highest black hole masses, and they also have the highest accretion rates — the rates at which material falls into the black holes.

“We're interested in observing the most luminous quasars because the very high amount of energy that they're generating down at their cores should lead to the largest impact on the host galaxy by the mechanisms such as quasar outflow and heating,” said Chris Willott, a research scientist at the Herzberg Astronomy and Astrophysics Research Centre of the National Research Council of Canada (NRC) in Victoria, British Columbia. Willott is also the Canadian Space Agency's Webb project scientist. “We want to observe these quasars at the moment when they're having the largest impact on their host galaxies.”

An enormous amount of energy is liberated when matter is accreted by the supermassive black hole. This energy heats and pushes the surrounding gas outward, generating strong outflows that tear across interstellar space like a tsunami, wreaking havoc on the host galaxy.

Outflows play an important role in galaxy evolution. Gas fuels the formation of stars, so when gas is removed due to outflows, the star-formation rate decreases. In some cases, outflows are so powerful and expel such large amounts of gas that they can completely halt star formation within the host galaxy. Scientists also think that outflows are the main mechanism by which gas, dust and elements are redistributed over large distances within the galaxy or can even be expelled into the space between galaxies — the intergalactic medium. This may provoke fundamental changes in the properties of both the host galaxy and the intergalactic medium.

Examining Properties of Intergalactic Space During the Era of Reionization

More than 13 billion years ago, when the universe was very young, the view was far from clear. Neutral gas between galaxies made the universe opaque to some types of light. Over hundreds of millions of years, the neutral gas in the intergalactic medium became charged or ionized, making it transparent to ultraviolet light. This period is called the Era of Reionization. But what led to the reionization that created the “clear” conditions detected in much of the universe today? Webb will peer deep into space to gather more information about this major transition in the history of the universe. The observations will help us understand the Era of Reionization, which is one of the key frontiers in astrophysics.

NASA's Webb Will Use Quasars to Unlock the Secrets of the Early Universe

The team will use quasars as background light sources to study the gas between us and the quasar. That gas absorbs the quasar's light at specific wavelengths. Through a technique called imaging spectroscopy, they will look for absorption lines in the intervening gas. The brighter the quasar is, the stronger those absorption line features will be in the spectrum. By determining whether the gas is neutral or ionized, scientists will learn how neutral the universe is and how much of this reionization process has occurred at that particular point in time.

"If you want to study the universe, you need very bright background sources. A quasar is the perfect object in the distant universe, because it's luminous enough that we can see it very well," said team member Camilla Pacifici, who is affiliated with the Canadian Space Agency but works as an instrument scientist at the Space Telescope Science Institute in Baltimore. "We want to study the early universe because the universe evolves, and we want to know how it got started."

The team will analyze the light coming from the quasars with NIRSpec to look for what astronomers call "metals," which are elements heavier than hydrogen and helium. These elements were formed in the first stars and the first galaxies and expelled by outflows. The gas moves out of the galaxies it was originally in and into the intergalactic medium. The team plans to measure the generation of these first "metals," as well as the way they're being pushed out into the intergalactic medium by these early outflows.

The Power of Webb

Webb is an extremely sensitive telescope able to detect very low levels of light. This is important, because even though the quasars are intrinsically very bright, the ones this team is going to observe are among the most distant objects in the universe. In fact, they are so distant that the signals Webb will receive are very, very low. Only with Webb's exquisite sensitivity can this science be accomplished. Webb also provides excellent angular resolution, making it possible to disentangle the light of the quasar from its host galaxy.

The quasar programs described here are Guaranteed Time Observations involving the spectroscopic capabilities of NIRSpec.

The James Webb Space Telescope will be the world's premier space science observatory when it launches in 2021. Webb will solve mysteries in our solar system, look beyond to distant worlds around other stars, and probe the mysterious structures and origins of our universe and our place in it. Webb is an international program led by NASA with its partners, ESA (European Space Agency) and the Canadian Space Agency.

‘We are airborne!’ Stratolaunch sends the world’s biggest plane on second test flight

by Alan Boyle on 2021 April 29

<https://www.geekwire.com/2021/airborne-stratolaunch-sends-worlds-biggest-airplane-second-test-flight/>



Stratolaunch's Roc carrier plane flies above California's Mojave Desert. (Stratolaunch via Twitter)

Stratolaunch, the aerospace company founded by the late Seattle billionaire Paul Allen, put the world's biggest airplane through its second flight test today, two years after the first flight.

“We are airborne!” Stratolaunch reported in a tweet.

Today's takeoff from California's Mojave Air and Space Port at 7:28 a.m. PT marked the first time the plane, nicknamed Roc after the giant bird of Arabian and Persian mythology, got off the ground since Stratolaunch's acquisition by Cerberus Capital Management in October 2019.

Roc rose as high as 14,000 feet and traveled at a top speed of 199 mph during a flight that lasted three hours and 14 minutes — which is close to an hour longer than the first flight on April 13, 2019. During that earlier flight, the airplane reached a maximum speed of 189 mph and maximum altitude of 17,000 feet.

Zachary Krevor, Stratolaunch's chief operating officer, said today's flight accomplished all of its test objectives by checking the performance of improved instrumentation, a more robust flight control system and an environmental control system that allowed the pilots to work in a pressurized cockpit. Krevor said the crew included chief pilot Evan Thomas, pilot Mark Giddings and flight engineer Jake Riley.

Recap from yesterday. Roc flew for 3 hours and 14 minutes at a max altitude of 14,000 ft. and a max speed of 178 kts. Beautiful shot from our chase plane. More tests in the works. pic.twitter.com/Ib9mYnqY1Z

— Stratolaunch (@Stratolaunch) [May 1, 2021](#)

‘We are airborne!’ Stratolaunch sends the world’s biggest plane on second test flight

The flight’s spiciest moment came at touchdown, when one of the mammoth plane’s landing gears settled the runway while the other was still in the air. “We did touch down initially on one gear, but that’s exactly the technique we prefer to use during a crosswind landing,” Krevor told GeekWire during a post-landing teleconference. “Though we stayed within our crosswind limits, we did have a little bit of a crosswind, and the aircrew did an excellent job of bringing the aircraft down.”

Since Roc’s first flight in 2019, the business model for the 10-year-old venture has shifted: In its early years, Stratolaunch focused on using Roc as a flying launch pad for sending rockets and their payloads to orbit. The concept capitalizes on the air launch system pioneered by SpaceShipOne, which won financial backing from Allen and won the \$10 million Ansari X Prize in 2004,

The new owners still expect to use Roc for air launch, but the current focus is on using the plane as a testbed for Stratolaunch’s hypersonic flight vehicles. Once the plane is cleared for regular operations, perhaps next year, Stratolaunch could begin launching its Talon-A prototype hypersonic plane.

Touchdown!! Successful flight tests to round out the day. What a beautiful sight.
pic.twitter.com/gdssjvoN8x

— Stratolaunch (@Stratolaunch) April 29, 2021

David Millman, Stratolaunch’s chief technology officer, said the company plans to build three hypersonic vehicles. He said that should open the way for conducting hypersonic tests at least once every 17 days, matching the tempo of flights for the X-15 rocket plane in the 1960s,

Hypersonic flight at five times the speed of sound is a big deal for military applications. Russia and China are said to be working on hypersonic weapons systems, and the U.S. military is keen to keep up. Stratolaunch expects its technology to figure in the Pentagon’s plans.

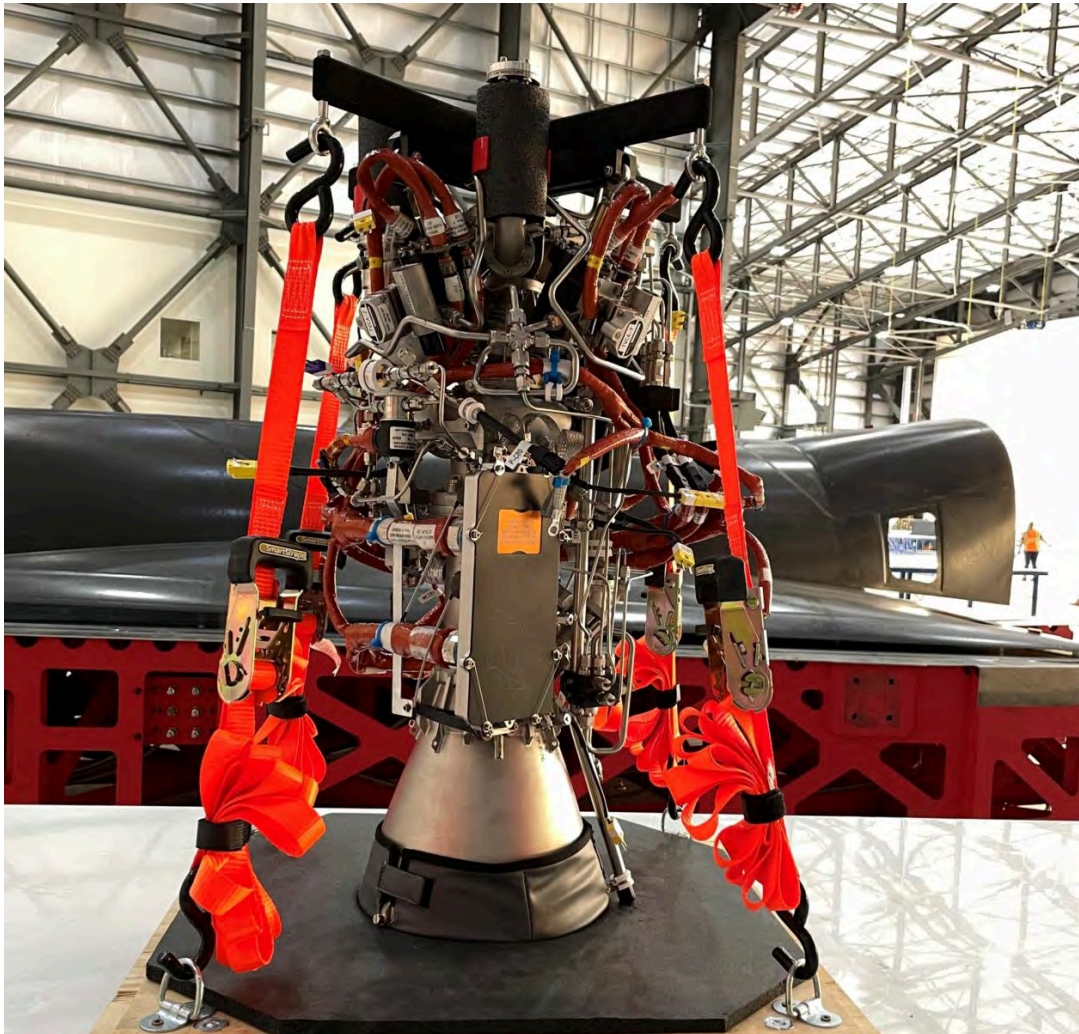
“That’s exactly one of the areas that we’re looking at: how can we help the Department of Defense in mitigating risks for all their extensive flight testing,” Millman told GeekWire.

Millman said Stratolaunch’s Talon testbed will be able to carry payloads, test materials and fly a variety of profiles that can help the Pentagon determine characteristics of hypersonic flight before it conducts costly full-blown flights of its own hypersonic vehicles.

“What we’re doing is providing a path or them to test a lot of their technologies in a simpler way, in a repeatable way, in a useful way so that they can get to their all-up rounds much quicker,” Millman said.

Stratolaunch hasn’t ruled out eventually pursuing other applications for its launch system, including sending satellite payloads and crewed space planes into orbit.

‘We are airborne!’ Stratolaunch sends the world’s biggest plane on second test flight



Stratolaunch’s Talon-A hypersonic vehicle is slated to use Ursa Major Technologies’ Hadley rocket engine, shown in the foreground. The airframe structure for a Talon-A prototype designed for flight separation testing is visible in the background. (Stratolaunch Photo)

Other companies, principally including Virgin Orbit, are also working on next-generation air launch technology. Such systems hold the promise of greater versatility and quicker response time for launching payloads, due to the fact that the carrier planes can take off from a wide variety of runways, fly around inclement weather and theoretically launch their payloads in any desired orbital inclination.

Stratolaunch’s twin-fuselage, six-engine Roc airplane is in a class by itself, thanks to its world-record wingspan of 385 feet. In comparison, the wingspan of the modified Boeing 747 that Virgin Orbit is using comes to 211 feet. The previous record-holder was the Spruce Goose, a prototype seaplane that made its debut in 1947 and had a 320-foot wingspan. Built by Mojave-based Scaled Composites, Roc has the capacity to carry more than 500,000 pounds of payload.

This is an updated version of a report first published at 10:31 a.m. PT April 29.

GeekWire contributing editor Alan Boyle is an award-winning science writer and veteran space reporter. Formerly of NBCNews.com, he is the author of "The Case for Pluto: How a Little Planet Made a Big Difference." Follow him via CosmicLog.com, on Twitter @bOyle, and on Facebook and MeWe.

Launcher opens HQ & Factory in Los Angeles, California

(2021 June 18) <https://launcherspace.com/blog/launcher-opens-hq-factory-in-los-angeles-california>



Photo: Launcher HQ (Credit: John Kraus)



Photo: Launcher team (Credit: John Kraus)

On June 18, 2021, Launcher inaugurated its first rocket factory and new headquarters in Hawthorne, California.

The building includes a 4,000 square-foot office area and a 20,000 square-foot rocket factory floor - featuring 2,000 amps of power and machine tools from Haas, Doosan, Sodick, Flex Arm as well as a Velo3D Sapphire metal (Inconel) 3D printer. Many more machines are on the way, including an AMCM M4K copper alloy-capable 3D printer.

Max Haot, founder and CEO of Launcher, inaugurated Launcher headquarters with a few words to the team: “No one ever built a ship without a shipyard,” Haot announced. “This is our first shipyard, a prerequisite to reaching the stars, and a very special day for our team.”

It is a long journey to orbit, but the opening of Launcher HQ and factory further paves the way. The Launcher team pushes on towards the development of the world’s most efficient rocket to deliver small satellites to orbit. The new headquarters brings new opportunities for scaling the team. Launcher is hiring now - [come join us!](#)



Photo: Launcher HQ office (Credit: John Kraus)



Photo: Launcher E-2 Combustion Chamber inside the Haas UMC-1000 CNC Machine.

Space Industry Veteran David Caponio Joins Launcher Leadership Team

Continues to Strengthen Launcher's Team with Decades of Experience at SpaceX, Virgin Orbit, U.S. Space Force and More. (2021 July 15)

<https://launcherspace.com/blog/announcing-launcher-head-of-product-business-development-david-caponio>

Hawthorne, California. July 15, 2021 – Launcher today announced that commercial space executive David Caponio has joined its leadership team as the **Head of Product and Business Development**. David brings two decades of both customer and provider experience in the commercial space launch sector, including at SpaceX, Virgin Orbit, and Tyvak and in the U.S. Government, as a military officer supporting launch and space development programs at the U.S. Space Force and the U.S. Air Force.

David's announcement highlights the continuous strengthening of Launcher's leadership team and follows Launcher's finalization of \$11.7M in Series A funding in June. Launcher is unique in the small satellite launch services market for its high-performance, 3D printed copper alloy staged combustion liquid rocket engines. The company is on track to reach orbit in 2024 at the lowest total investment in history.

David has provided decades of service to the U.S. Government as an active and reserve military officer, as well as a government consultant for launch and small satellite development to the U.S. Air Force and Space Force. He obtained his MS in Systems Engineering from the Air Force Institute of Technology and BS in Aeronautical Engineering from the U.S. Air Force Academy.



David Caponio, Head of Product and Business Development, Launcher



From left to right: David Caponio, Head of Product and Business Development, Max Haot, Founder & CEO, Kevin Watson, Head of Avionics, and Igor Nikishchenko, Chief Designer, Launcher

"We are very excited to welcome David to the Launcher team. David's experience as both a customer and provider of satellite launch services positions Launcher to better serve our customers and guide product development that is best in the industry" said Max Haot, CEO of Launcher.

"I'm thrilled to join Launcher. Launcher's high-performance design enables our launch services to be competitively priced and profitable -- serving the needs of the exponentially growing small satellite market," said David Caponio.

Launcher is actively hiring for its headquarters and factory in Hawthorne, California. Interested candidates can visit launcherspace.com/careers to learn more.

Relativity Announces New 1M+ Sq. Ft. Factory Headquarters in Long Beach, CA

New HQ Accommodates Scaling Production for Terran R, Fully Reusable, Entirely 3D Printed Rocket (2021 June 30)

<https://www.relativityspace.com/press-release/2021/6-30/relativity-space-new-headquarters>



Long Beach, California (June 30, 2021) – Relativity Space, the first company to 3D print an entire rocket and build the largest metal 3D printers in the world, today announced a major expansion of its operations in Long Beach with the signing of a new, 1M sq. ft. headquarters factory at Goodman Commerce Center, Long Beach.

As a 93-acre former Boeing C-17 manufacturing plant in Long Beach, the new Relativity headquarters, designed in collaboration with Gensler, is one of the largest headquarters in the private space industry. Relativity Headquarters will have capacity for 2,000+ employees, metallurgical laboratory, DMLS printers, mission control center, as well as dozens of the company's proprietary Stargate 3D printers, the largest metal 3D printers in the world. With software changes, Relativity's Stargate printers are capable of printing both Terran 1, the world's first entirely 3D printed launch vehicle and its fully reusable, entirely 3D printed rocket, Terran R.

The announcement builds on the company's continued momentum, including its reveal of Terran R, the closing of its \$650M Series E fundraise, and an unprecedented year of job creation. Relativity now employs 450+ people, growing 300% within the last year, across its Long Beach, Vandenberg, Seattle, Washington D.C., Stennis, and Cape Canaveral locations. The company is on track to hire 200+ additional employees by the end of the year.

With its expansion, Relativity is doubling down on its Factory of the Future, which is centered on Stargate, the world's largest 3D printer that the company created in-house. Through collaboration between humans and machines, Relativity's Factory of the Future fuses 3D printing, artificial intelligence, and autonomous robotics. Disrupting 60 years of aerospace, Relativity's radically simplified supply chain enables the company to print its rockets with 100x fewer parts in less than 60 days.

Due to its novel use of automation, Relativity's Factory of the Future was operational during COVID-19, working safely with key Stargate operators, keeping the company on track for the launch of Terran 1 later this year. Incorporating AI-driven controls, Relativity's Stargate 3D printers continuously optimizes production, resulting in exponentially compounded quality and time improvements, lower costs, and product designs not possible in traditional aerospace manufacturing.

Relativity Announces New 1M+ Sq. Ft. Factory Headquarters in Long Beach, CA

“Relativity is at the forefront of an inevitable shift to software-driven manufacturing, and the opportunity to reimagine this facility for the future of aerospace is incredibly exciting,” said Tim Ellis, CEO and co-founder of Relativity. “Securing this space for Relativity Headquarters, which is now one of the largest facilities in private space, right here in Long Beach, is key for scaling out our Terran R program, while also continuing to tap into the unparalleled talent here to join us on our mission.”

As part of Long Beach City Council’s recently passed Globemaster Corridor Specific Plan, the new Relativity headquarters is part of 437 acres of coveted land west of Long Beach Airport that will be transformed into a modern business district, commencing over the coming weeks with move in planned for January 2022.

“We want to welcome Relativity Space to Space Beach, and we couldn’t be more excited to welcome their new 1M square foot headquarters to our city,” said Mayor Robert Garcia. “Relativity is a growing leader in our world’s space economy, and we’re proud they chose Long Beach as home. This new HQ will bring thousands of great, good-paying jobs to Long Beach and strengthen economic growth for the entire region.”

Goodman Group, one of the largest global industrial property groups, will be working with local stakeholders and communities to create employment opportunities, and demonstrate sustainable and innovative use of the spaces. Architecture and design firm, Gensler, will be collaborating with Relativity to completely reimagine the space.

Anthony Rozic, CEO of Goodman North America said, “The adaptive re-use of this iconic Long Beach building sees Goodman deliver our global strategy of being leaders in sustainability and providers of unique real estate solutions for our customers in rare strategic locations. We know that regeneration of existing sites will have the lowest impact on the environment. Partnering with the City of Long Beach, the site has been sustainably redeveloped removing the need for large scale demolition and new construction. In Relativity, we found the ideal partner for the space providing thousands of job opportunities for the Long Beach community. At Goodman, our purpose is ‘making space for greatness’ which I have no doubt Relativity will achieve as they expand their vertically integrated technology platform and 3D manufacturing capabilities.”

The company’s existing Long Beach facility will continue to be utilized for Terran 1 production. To learn more about Relativity Space and its multiplanetary mission, visit relativityspace.com.

About Relativity Space

Relativity is building humanity’s multiplanetary future. We invented a new approach to design, print, and fly our own rockets, starting with the world’s first entirely 3D-printed rocket, Terran 1, and Terran R, a larger, fully reusable, entirely 3D-printed launch vehicle.

As a vertically integrated technology platform, Relativity is at the forefront of an inevitable shift toward software-defined manufacturing. By fusing 3D printing, artificial intelligence, and autonomous robotics, we are pioneering the factory of the future. Disrupting 60 years of aerospace, Relativity offers a radically simplified supply chain, building a rocket with 100x fewer parts in less than 60 days.

We believe in a future where interplanetary life fundamentally expands the possibilities for human experience. Our long-term vision is to upgrade humanity’s industrial base on Earth and on Mars.

Relativity Space is backed by leading investors including Baillie Gifford, Blackrock, BOND, Coatue, Fidelity, General Catalyst, ICONIQ Capital, K5 Global, Mark Cuban, Playground Global, Social Capital, Tiger Global, Tribe Capital, Y Combinator, and 3L. For more information, please visit relativityspace.com or connect with us on [LinkedIn](#), [Twitter](#), [Instagram](#) or [YouTube](#).

COVID-19 and UAS

by Dr. Sudhir Kumar Chaturvedi, Associate Professor, Department of Aerospace Engineering, UPES Dehradun, India

In the appearance of the global COVID-19 pandemic, there have been reported attempts to utilize Unmanned Aerial System (UAS) technologies in changed set-ups, albeit, mainly intermittently and not at scale. This brief correspondence note provides the examination of publicly gained information on the use of UAS in rejoinder to COVID-19 and shares some considerations on whether and how UAS could be of an assistance in the given pandemic state of affairs (<https://doi.org/10.3390/drones3030071>).

UAS are flying robots that can be remotely controlled or fly self-governing by programming-controlled flight designs in their installed frameworks, working related to locally available sensors. Applications of UASs are widely increasing around the world for civilian, commercial as well as military purposes (<https://doi.org/10.1109/MIC.2018.032501511>). I have examined some of the applications of UASs and the possible futuristic applications of UASs in India/globe. This correspondence explores the use of UAS in tackling the COVID-19 situation such as lab sample pickup and delivery, spraying of the sanitizer in micro contentment zone and micro contentment zones, delivery of medicines, public space monitoring and guiding the public for better navigation. Since these flying machines are, fast and do not endanger human life. Until now, UASs in India are primarily used for observation, reconnaissance and air navigation in military and defense zones. It is therefore important to establish more UAS-based research specially in the autonomous technologies for guiding and monitoring the COVID-19 situation across the lockdown zones.



Drone deployment for Sanitization

(<https://www.newindianexpress.com/cities/chennai/2020/jul/01/the-aerial-killer-2163581.html>)



UAS to monitor public gatherings

(<https://www.activistpost.com/2015/04/india-becomes-first-country-to-approve.html>)



Dr. Sudhir Kumar Chaturvedi

Bio War: Indian Defense System against Covid-19

by Dr. Sudhir Kumar Chaturvedi, Associate Professor, Department of Aerospace Engineering, UPES Dehradun, India

The pandemic crisis seems to have an economic impact, as well as a significant psychosocial impact. The general decline in economic activity, or recession, may last for several quarters, stifling economic growth. As the coronavirus pandemic threatens to cause an economic downturn, it is also causing a "social recession" social distancing and alienation, the decline in social interaction and change in mental and physical health have been observed. Economic slowdowns are easy to quantify, but the long-term damage to social, cultural, and communal bonds may be equally damaging. A covid affected patient's social rehabilitation and psychological support are just as important as their timely diagnosis and medical care. As India battles the second wave of coronavirus, the India's armed forces have left no stone unturned in consolidation the fight against Covid-19.

The Defence Research and Development Organisation (DRDO) has set up a Covid-19 hospital in Delhi with a capacity of 250 beds. It's capacity will be increased to 500 beds and subsequently to 1,000 beds if required. With this technology, 1,000 litres of oxygen can be produced per minute. This technology was developed for the LCA (light combat aircraft) Tejas. Indian Army, Air Force, Navy, and other organizations of the Ministry of Defence like DG AFMS, DRDO, OFB, DPSU, NCC, Cantonments Boards, etc are engaged to help mitigate the sufferings of the people. Mobilisation of additional health professionals, setting up of new COVID facilities, deployment of IAF transport aircraft and IN Ships to provide logistic support to facilitate the supply of oxygen from friendly foreign countries and within the country and setting up of new oxygen plants are some of the ongoing efforts of the Ministry of Defence. Defence PSUs pitch in Various DPSUs, including Hindustan Aeronautics Limited (HAL), and Ordnance Factory Board are providing COVID care services, including oxygen beds, at their facilities in several places across the country, in coordination with different State Governments. A180-bed COVID care centre, with ICU, oxygen and ventilator support, set up by Hindustan Aeronautics Limited (HAL) is functional in Bengaluru, Karnataka. As the whole of India stands united in the fight against htie Covid-19 Bio war, the Armed Forces are walking the extra mile for the nation to arise a winner. Hard times demand the appearance of an unconquerable spirit to fight against the enemy and that is what the country is doing now.

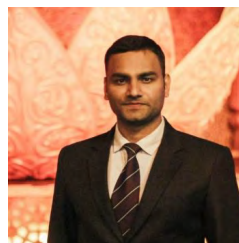


Beds deployment by DRDO

(<https://www.indiatoday.in/coronavirus-outbreak/story/covid-19-defence-ministry>)



IAF roped in to airlift oxygen tankers as India battles fresh wave of Covid-19 (Source PTI, <https://www.indiatvnews.com/news/india/indian-air-force-roped-in-to-airlift-oxygen-tankers-as-india-battles-fresh-wave-of-covid-19-699912>)



Dr. Sudhir Kumar Chaturvedi

The myth of ethical AI in war

Defense ministries around the world are rightly anxious to infuse their military systems with artificial intelligence

by Dr. Stephen Bryen, Former Deputy Under Secretary of Defense, 2021 July 15

<https://asiatimes.com/2021/07/the-myth-of-ethical-ai-in-war/>



Installing ethics into AI-connected weapons is easier said than done. Photo: AFP / Benoît Bacou / Photononstop

US Secretary of Defense Lloyd Austin wants the Defense Department to do artificial intelligence (AI) “the right way,” even if our main competitor, China, does not.

Speaking to the National Security Commission on Artificial Intelligence Austin said: “... our use of AI must reinforce our democratic values, protect our rights, ensure our safety and defend our privacy.”

This is close to the formula assigned to the fictional “Officer Murphy” in the 1987 movie Robocop. Murphy, a murdered police officer, was turned into Robocop, a cyborg with his human memory (mostly) erased.

He was given four directives, the first three being to serve the public trust, protect the innocent and uphold the law. He was also given a classified order, Directive 4, which blocked Robocop from causing harm to employees of Omni Consumer Products (OCP), the company that built him.

This was an attempt to install company ethics in a cyborg.

Sort of like attempting to install American military ethics in an AI-enhanced weapon. Secretary Austin appears to believe in Officer Murphy, but the ethics of warfare, practiced by the United States or our allies or our adversaries, are in the soldiers and commanders.

If we can’t do this right now without AI, then we can’t do it with AI-enhanced weapons.

Defense ministries around the world are anxious to infuse military systems with AI. Building on the success of surveillance and armed drones and their increasing combat importance, the US, Israel, Russia and China are all seeking autonomous war-fighting systems.

At their simplest, these are capable of carrying out a task without a person in the loop. A drone can be sent to destroy a target without any communication or control system outside the weapon itself.

The myth of ethical AI in war

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The immediate fiery aftermath of the missile and drone attacks at Abqaiq on September 15, 2019, in Saudi Arabia. Photo: Screengrab

When the Iranians sent cruise missiles and drones against Saudi Arabian oil installations in September 2019, it appeared to some experts that the drones that hit the Abqaiq oil facility were operating autonomously. Autonomy, however, only lets a weapon do the job it is programmed to do. AI has the weapon making decisions.

In some cases, that seems fairly straightforward.

During the Gaza conflict in May, Israel claims to have launched and operated a large swarm of drones that were managed by AI. According to recent reports, the drones each covered a preselected surveillance area and were capable of sending coordinates back to gun and mortar brigades to attack the selected targets.

The technology is said to have been developed by the Israeli army's Unit 8200 specializing in signals intelligence – roughly equivalent to the National Security Agency (NSA) in the United States. Israel has not provided detailed information about the drone swarms, but it makes sense that each drone not only could map a specific area but could also detect missile launch sites and other military activities and select them as targets.

Whether there was a person in the loop or not – the likelihood is not – isn't known.

The US is working on a number of autonomous vehicles ranging from land systems to surface and underwater naval vessels to autonomous refueling aircraft. The army, for example, is adding AI capability to land vehicles, including tanks that ultimately will be able to coordinate with surveillance drones and select the safest available roadways, predict where blockages may be and automatically take alternative action.

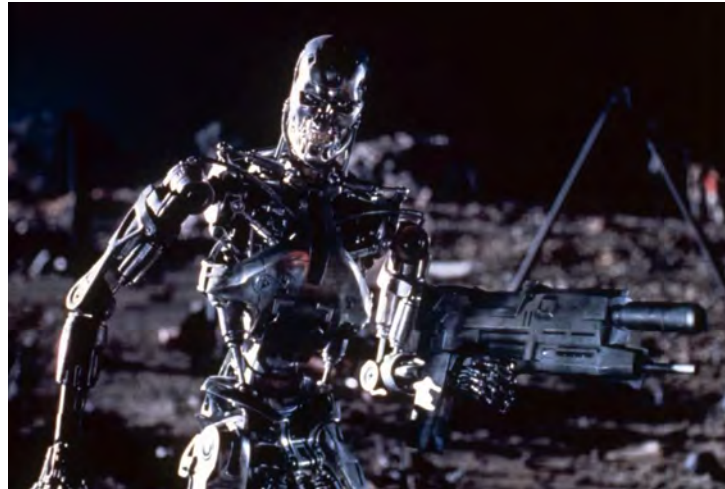
These systems are built on civilian technology developed in Israel – eg, WAZE – and in the US – self-driving vehicles, pioneered by Tesla.

Some of this is readily apparent in targeting and killing terrorists using drones and hellfire missiles. The US has been at this for many years now, with considerable success, but it has occasionally hit the wrong target.

These are not AI systems currently, but it is a singular path to “improve” them with AI so that the AI has instructions that it carries out without external decision making – “Did we choose the right target?” or “Is there too great a danger of collateral damage?”

The myth of ethical AI in war

Defense ministries around the world are rightly anxious to infuse their military systems with artificial intelligence



AI-controlled soldiers might do a better job in close combat, but there are limitations. Photo: AFP / Carolco Pictures

The real crunch comes when we get to the future soldier. To make the future soldier effective, he or she has to eliminate perceived threats before the threats eliminate them. Thus, the soldier is not actually a cyborg, but his or her capabilities are reaching a cyborg level of capability.

There is no reason to believe that an AI-driven system would be any better or worse than a purely human-operated system. Furthermore, in a complex combat environment, AI might do a better job than stressed humans fighting for their lives.

AI can be programmed to obey some “ethical” rules, particularly when it comes to civilians in a combat environment, but commanders may find this programming interferes with the mission if built-in “ethical” limitations endanger warfighters.

For example, an AI system might lock a soldier’s gun to prevent a civilian from being killed, when in fact the civilian is a combatant or terrorist.

In urban terror events, it is virtually impossible to know who is, or is not, a civilian. Israel, for example, has been struggling, with or without AI, how to minimize civilian casualties when terrorists launch rockets from mosques, schools and apartment buildings.

AI is not going to solve this problem by itself or even in combination with human operators.

Our adversaries are not in the least worried about constraints on the use of AI. While it is practically impossible to make AI “ethical,” it is possible and absolutely essential to press our military and civilian leaders to act ethically and unleash weapons only when justified and essential for our security.

In short, while ethical AI may be a myth, ethical leaders are not in the least mythological.

US lacks credible response to Chinese hacking

US government needs to overhaul its entire approach to network security but there is reason to doubt that will happen
by Dr. Stephen Bryen, Former Deputy Under Secretary of Defense, 2021 July 20

<https://asiatimes.com/2021/07/us-lacks-credible-response-to-chinese-hacking/>



Chinese hacking is a rising and major security concern in the US. Image: iStock/Getty Images

A new report by the US National Security Agency (NSA), Central Intelligence Agency (CIA) and the Federal Bureau of Investigation (FBI) reveals just how difficult, if not impossible it is, to fix cyber vulnerabilities caused by Chinese-supported intrusions.

It does not offer an alternative to current-day computing networks and is indifferent to Cloud-based networks as being any more secure than wired networks.

The bottom line is that the critical infrastructure, which includes key industries, business, government and military systems, remains hostage to Chinese hacking and represents a major national security danger to the US and its allies, far surpassing the Russian ransomware attacks that also have hit some infrastructure targets.

The report is titled “Chinese State-Sponsored Cyber Operations: Observed TTPs.”

A key finding of the report is the massive intrusion of Microsoft Exchange servers, which Microsoft advertises as “efficient and secure.” The report makes clear this is not the case.

The Microsoft Exchange server supports Microsoft 365, which includes the Microsoft product line including Office, Skype for Business, PowerPoint, Planner, some Mobile Apps and Outlook email. It is cloud-based.

On July 6, the US Defense Department canceled a US\$10 billion master cloud contract with Microsoft under a program called JEDI (Joint Enterprise Defense Infrastructure). While all public reporting has pointed to a dispute between the government and Amazon, a competitor for the JEDI contract, by July the DOD would have been well aware of Chinese hacking and Microsoft’s vulnerabilities, as the NSA is run by the Defense Department.

TTPs are jargon for “tactics, techniques and procedures” and refers to the different ways China and hackers China hires to carry out attacks on “US and allied political, economic, military, educational and critical infrastructure (CI) personnel and organizations to steal sensitive data, critical and emerging key technologies, intellectual property and personally identifiable information (PII).

“Some target sectors include managed service providers, semiconductor companies, the Defense Industrial Base (DIB), universities and medical institutions. These cyber operations support China’s long-term economic and military development objectives.”

US lacks credible response to Chinese hacking

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The Microsoft Exchange servers were a target. Photo: AFP / Sebastian Kahnert / dpa

China's ability to respond

The report goes through a long list of ways Chinese-led hackers penetrate US and allied networks, including even tracking what the US and allied cybersecurity community is doing to protect networks in order to circumvent and blunt security efforts.

One of the top techniques is China's ability to rapidly respond to any report of a new vulnerability. When such a vulnerability is revealed, often first in technical literature and well before patches or other remedial steps can be taken to fix any hole in a networked or stand-alone system, Chinese hackers undertake a mass effort to use knowledge of the unpatched and unrepaired vulnerabilities to go after top targets.

Much of this involves the theft of intellectual property, which includes national security-related new technology or products, commercial and business proprietary information and increasingly medical research data, such as information on new drugs, treatments and vaccines.

Some of the Communist Party elite have ownership of Chinese Pharma companies, largely through their children and grandchildren.

There is no official estimate on how much has actually been stolen from the United States. The author believes that a large part of the US research and development (R&D) budget has been compromised by China.

One feature of research grants from organizations such as the US Defense Advanced Research Projects Agency (DARPA) is that most of the funds go to work that isn't classified and where encryption and file protection is more the exception than the rule.

Anytime US universities or independent researchers carry out sensitive work, most of the time they do so on the margins of the public domain, making cyber protection very difficult if not impossible.

China, according to the report, is also using a variety of attack modes, including the use of ransomware. Chinese-supported hackers use virtual private networks (VPNs) almost in the same way as using "burner" phones to hide their hack operations.

US lacks credible response to Chinese hacking

US government needs to overhaul its entire approach to network security but there is reason to doubt that will happen



A VPN gateway. Photo: AFP / Maxim Tumanov / Sputnik

No easy fix

A VPN is an encrypted network that hides the actual user and shields the user from discovery. By regularly changing VPNs, the Chinese hackers make it difficult for security agencies to go after the hack sources.

The most important part of the report, however, is found in Appendix A: “Chinese State-Sponsored Cyber Actors’ Observed Procedures.” It goes into significant detail on at least 41 “procedures” used by Chinese hackers and offers suggestions on how to try and protect against such hacks.

Anyone who reads the full listing and goes over the “Defensive Tactics and Techniques” will immediately recognize that implementing any of them would take a cyber army of sophisticated experts and, in any event, might not work at all.

There is also an Appendix B in the report called “MITRE ATT&CK Framework,” otherwise known as the MITRE Adversarial Tactics, Techniques and Common Knowledge (ATT&CK®) framework. The framework is “an open framework and knowledge base of adversary tactics and techniques based on real-world observations.”

Over the years the Pentagon has tried to put into operation comprehensive security measures for its computing assets, but has largely failed to consistently apply measures or even figure out how to authenticate how well security steps have been implemented.

One of the underlying problems is shifting personnel and support contractors. But there also are funding limitations, lack of skilled personnel, indifference and demands to keep networks running even if they are vulnerable because they are needed for urgent military requirements.

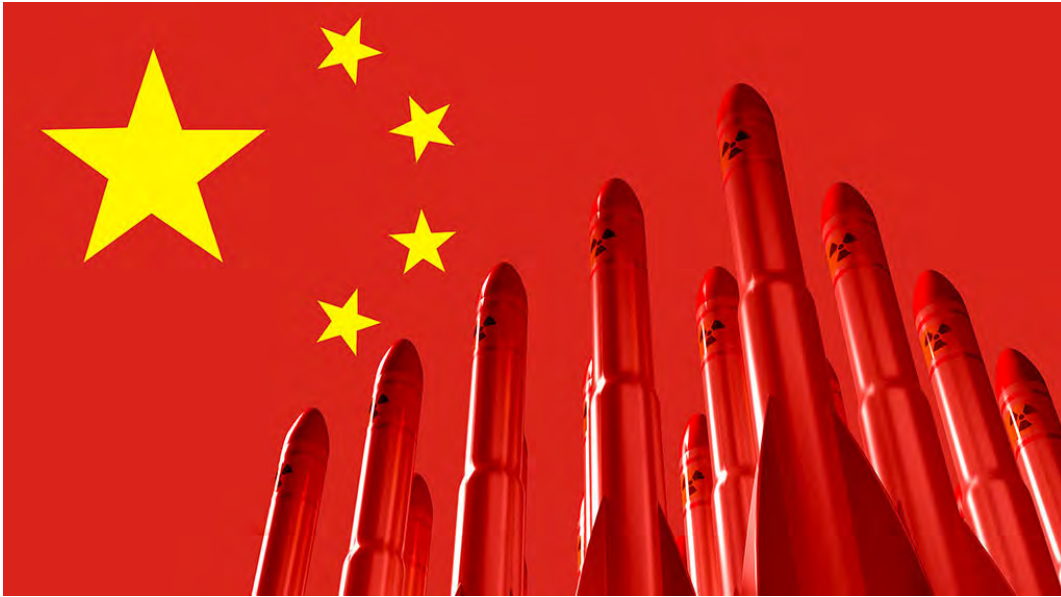
One of the reasons the DOD saw the JEDI contract as of critical importance is it would have consolidated many of the diverse networks into one cloud environment. Unfortunately, no one seems to have considered the vulnerability of a single cloud for surviving a national security disaster, and that was before the extent of Chinese hacks of Microsoft Exchange servers was known.

The US government needs to reconsider its entire approach to network security, but despite an exponential rise in cybercrime and cyber disruptions, the prospect for this happening remains low.

The reason why China threatens to “nuke Japan continuously”

by Dr. Stephen Bryen, *Former Deputy Under Secretary of Defense*, 2021 July 22

<https://centerforsecuritypolicy.org/the-reason-why-china-threatens-to-nuke-japan-continuously/>



In perhaps the most reckless threat ever made, China has threatened to “nuke Japan continuously” if Japan supports the US in protecting Taiwan from a Chinese invasion.

It is the first time ever that any state with nuclear weapons openly threatened a non-nuclear state with a nuclear attack –and not just any nuclear attack but a massive and continuous one.

The threat is in a video originally posted on a military comment channel on the Chinese video site called Xigua. It was soon removed, but after two weeks it has now reappeared on a Communist Party channel in Baoji, a major city in China’s northern province of Shaanxi. suggesting the threat is not just from some ultra-Chinese nationalist military people, but from the ruling Communist Party. After posting it in Baoji, it was also taken down.

So the question arises, what is going on here? Initially the video appeared in response to a Japanese White Paper that argued that a reunification threat by China to take Taiwan would pose “an existential” threat to Japan. The White Paper went on to suggest that Japan would have to support the US in backing Taiwan militarily.

Japan has quite a small military, in part because the Japanese constitution imposes a limit on Japan’s self defense forces, and in part because Japan has relied on the United States for its security. Last May Japan scrapped its 1% GDP cap on defense spending and increased its national budget to \$51 billion to include purchase of more stealth fighters, missile systems and warships. Japan mainly relies on the US Patriot air defense system for land-based defense, and on AEGIS for ship based ballistic missile protection. The country is building up to a fleet of 147 F-35 stealth fighter jets and is retiring its F-15J’s, which are now reaching end of life. In particular, Japan is planning to equip two Izumo-class helicopter carriers with the F-35B, giving Japan the ability to project power around China. In 2020 Japan launched the first of the new Soryu-class submarines, planning to buy 22 in all. These are diesel electric submarines and the first to use advanced lithium ion batteries. These submarines also have hydrogen power packs enabling them to stay submerged for much longer periods. Coupled to sophisticated silencing techniques, as these submarines come onstream Japan will have a strong capability to counter China’s growing fleet. (The US does not have diesel-electric submarines and relies entirely on nuclear powered submarines.)

The reason why China threatens to “nuke Japan continuously”

by Dr. Stephen Bryen, Former Deputy Under Secretary of Defense, 2021 July 22

But Japan does not have nuclear weapons. Occasionally some voices are raised saying that Japan needs such weapons. Back in February Japan, despite its strong anti-nuclear proliferation stance, refused to sign the new Treaty on the Prohibition of Nuclear Weapons. Neither the US, China, Russia nor any major European countries signed the treaty. Under the circumstances it would be wrong to misread Japan's intentions on not signing the new Treaty. Some say Japan could rapidly become a nuclear state if it wanted to do so, as it has a large stockpile of plutonium and an active space program to launch long range weapons. But it would take many years and a major change in policy that no doubt would spark major home opposition, given Japan's experience with the bombing of Hiroshima and Nagasaki and its post-World War II aversion to weapons of mass destruction.

Which is why the Chinese threat is crude and entirely inappropriate.

China know that the US has a defense treaty with Japan (Treaty of Mutual Cooperation and Security between the United States and Japan) and stations advanced fighter aircraft in Japan and on Okinawa that include F35's, F-18's, F-15's and F-16's along with AWACS and other surveillance aircraft. The US also bases a significant part of its Pacific fleet in Japan, including a home port for the USS Ronald Reagan (CVN 76), its forward deployed nuclear powered aircraft carrier. Any nuclear attack on Japan, therefore is sure to be a nuclear attack on the United States and would trigger massive American nuclear retaliation. Thus these recent threats are as much a nuclear strike threat against the United States as Japan, and there is no doubt at all the Japanese understand this well.

Moreover, any reunification attempt by China against Taiwan is highly unlikely to involve nuclear weapons for the simple reason that it would kill most of the densely packed population of Taiwan (about 26 million people) even in a relatively small strike and could also involve nuclear retaliation from the United States. Taipei city, for example, has about 2.7 million people and the nearby population around the city is over 7 million. On the other end of the island, Kaohsiung city, a major maritime port near where Taiwan's navy is based, has a population of nearly 2.8 million. There is no role for even tactical nuclear weapons other than to kill off an entire population, which would make a cruel joke out of the reunification idea.

So why prepare a crude threatening video that threatens to annihilate Japan and announces that China has changed its no first use nuclear weapon's policy by creating an exception for Japan?

One explanation is that the video reflects an internal policy fight in China between those who want to recklessly attack Japan and Taiwan, and those who are more sensible and reluctant to get the rapidly growing country into a war involving mass casualties and destruction. In short what we may be seeing is an extremely nationalistic pro-war faction in the military and the ruling Communist party fighting to get control of the country. In that context it looks like currently mainline Communist party operatives are taking down the video, and perhaps other internal manifestations of the argument, as fast as they can, while trying to look to the outside world as tough minded and decisively in favor of Taiwan reunification. Hu Xijin, the editor of China's Global Times, a mouthpiece for the regime, news says that Japan will be destroyed if it intervenes in a Chinese attempt to take Taiwan in a military invasion, but he says nothing about nuclear weapons and implies only that China is much stronger than Japan, which everyone knows. But Hu also avoids mentioning the United States and the role it would play. China's policy is to try and hoodwink the US into standing aside and not fighting in case China attacked Taiwan. What has really irritated Beijing is that Japan's new policy helps keep the US feet to the fire in protecting Taiwan.

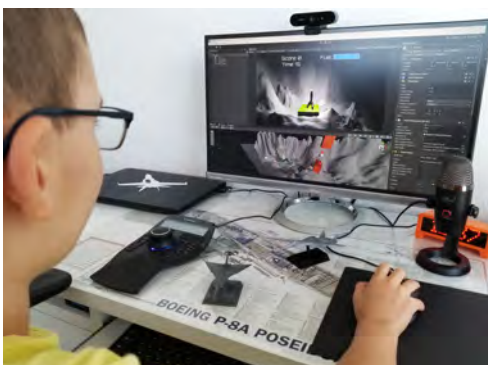
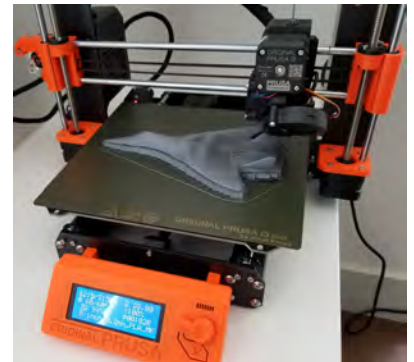
That's why some Chinese want to continuously nuke the Japanese.

Reaching for the Stars at a Young Age

by Max Trest, AIAA High School Member

Max Trest is a AIAA high school student member who does advanced CAD modeling using a SpaceMouse Enterprise, 3D prints his aircraft models, codes space related video games in Unity, and routinely attends AIAA events such as E-Happy Hours, technical symposiums, talks, and workshops. Some of the aircraft and spacecraft Max has CAD modeled include the Rockwell ATF by Dr. Dan Raymer which was live modeled in front of an audience for the AIAA LA-LV talent show last year, the Northrop YF-23, the Sukhoi Su-57, and SpaceX's Falcon Heavy. You can find some of Max's older models on his Thingiverse page: <https://www.thingiverse.com/virtualvisionary/designs>. More recently, Max has been working on coding his own video game in Unity which is inspired by the 1979 video game Lunar Lander and the many initiatives to colonize other planets such as Mars. The goal of Max's game is to navigate your rocket ship through obstacles on other planets with the end goal of landing your ship on platforms. Max is coding the game using Visual Studio C# and he designed the placeholder rocket ship model in Autodesk Fusion 360.

For a self-directed homeschool project several years ago, Max custom designed and CAD modeled his vision for a 5th generation stealth fighter which he then 3D printed. Prior to modeling his plane, Max studied different characteristics of stealth aircraft in order to ascertain what should be incorporated into his design. For a recent school egg drop challenge, Max created a paraglider with custom 3D printed airfoils however upon testing this design, he found that the airfoils made the paraglider too heavy. Max scrapped this design and instead built a foam space shuttle with an opening egg holding payload bay. You can see a YouTube video of Max's space shuttle here: <https://www.youtube.com/watch?v=Z2hK1okTWcE>. Watch until the end for the blooper reel!



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



(Jul 22) ASU University Thunderbird School Launches Master In Space Leadership



(Jul 21) US FAA expands air traffic control to include commercial space tourism



(Jun 29) INDO-PACOM Used Ground-based Aegis Combat System Prototype to Target Missile Threats, Surface Targets



Delbert Harold Jacobs
1932 - 2019



BRIGADIER GENERAL
DELBERT H. JACOBS



(Jul 1) SMC Eyes MEO Sats For Missile Tracking



(Jul 16) Curiosity rover discovers that evidence of past life on Mars may have been erased



(Jul 10) China wants to launch asteroid-deflecting rockets to save Earth from Armageddon



(Jul 12) Using 5G For Command & Control



(Jul 9) Air Force Adds 29 Companies to \$950M Joint All Domain C2 Support IDIQ



(Jul 8) A MYSTERIOUS hypersonic drone has been spotted at a Chinese airbase, it was reported.



(Jul 2) Satellite boom demands better space traffic management



(Jun 11) A New Era of Spaceflight? Exciting Advances in Rocket Propulsion



(Jun 17) Statements on Pam Melroy's Senate Confirmation as NASA Deputy Administrator



(Jun 14) The world's first wooden satellite will launch this year



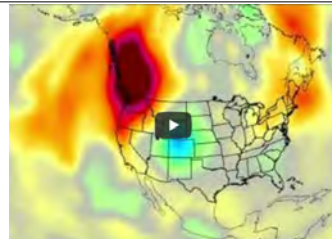
(Jul 6) NASA is Supporting the Search for Alien Megastructures



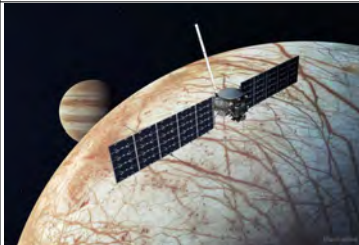
(Jul 14) China Building Hypersonic Jet to Ferry Passengers Around Globe and to Space



(Jul 27) China Developing Unique Laser Gun for Faster Hypersonic Missiles and Planes



(Jul 8) NASA's AIRS Tracks Record-Breaking Heat Wave in Pacific Northwest



(Jul 23) NASA Awards Launch Services Contract for Europa Clipper Mission



(Jul 23) Hubble Views a Faraway Galaxy Through a Cosmic Lens

Photography Gallery: Great Conjunction from 2020 December 21 (Dr. Robert Q. Fugate)

***Dr. Robert Q. Fugate** was the Speaker/Lecturer of the [AIAA Space 2015 von Kármán Lecture](#)*

Dr. Robert Q. Fugate has a 49-year career in electro-optics research, 35 years as a civilian scientist at the Air Force Research Laboratory and now consultant for DoD, academia, and industry. He is recognized as the “Father of Laser Guide Star Adaptive Optics,” the key technology that has enabled a revolution in extremely large ground-based telescopes to see clearly through the turbulent atmosphere.



On December 21, 2020 Jupiter and Saturn came very near to each other in the sky - a Great Conjunction. On their orbital racetracks around the Sun, Jupiter passes Saturn in the sky about every 20 years, but what made this event special is the conjunction was the nearest the giant planets had been to each other in nearly 400 years, and the nearest at night in nearly 800 years.

To photograph this once in a millenium event, I borrowed a Meade 7-inch Maksutov telescope, focal length 2670 mm, and attached my Nikon D850 camera. I put the telescope and camera on my Skywatcher NEQ6 German equatorial mount. I am not a planetary imager, so don't have the proper high frame rate camera or post processing software to make high definition planetary images, but decided to do what I could with what I had and could borrow.

There were two challenges to making a good image, seeing and atmospheric dispersion. The planets were already low in the sky (20 degrees elevation and going down) at dark. The low elevation means looking through much more turbulent air and also creates a prism effect, spreading the image vertically across the visible spectrum, reducing the resolution and causing color fringes. Of course it is useful to make these excuses as an apology for not creating a really great image.

The image presented here is a composite - the blending of two images. One is the image of the two planets and Jupiter's moons which was made by stacking 74 RAW frames exposed for 1/20 sec at ISO 800. The second image is a 3 second exposure at ISO 1600 to reveal a few of Saturn's 82 moons and this image was combined with the image of the planets in Photoshop. Jupiter's moon Ganymede was shy and hiding behind the planet. I have labeled the moons detected - along with a 8.9 magnitude star. The image is oriented approximately how it appeared in the sky from Albuquerque, NM, USA at 5:20 PM local time December 21, 2020. The angular distance between Jupiter and Saturn is 6 arc min or 0.1 degree, 1/5 the diameter of the full moon. Jupiter is 553 million miles from Earth and Saturn is 1.013 billion miles from Earth (light travel time is 90 minutes).

Photography Gallery: Great Conjunction from 2020 December 16 (Dr. Robert Q. Fugate)



The Great Conjunction - T Minus Five Days

This image was made on December 16, 2020 — 5 days before Jupiter and Saturn were at minimum separation. It is a single exposure: Nikon D850, Sigma Art 105 mm F1.4 lens at f/4.0, 2 seconds shutter time, camera and lens mounted on an equatorial tracker. Time was 5:41 PM MDT. Two of Jupiter's moons are visible: Callisto above Jupiter and Ganymede below Jupiter; Io and Europa are hidden by the planet. You can even see the slight elongation of Saturn's rings.

Photo Diary: Spacefest and the July Moon-Venus-Mars Conjunction (Ms. Michelle Evans)

Ms. Michelle Evans is the AIAA Distinguished Speaker (Click to see **AIAA Member Spotlight**)

Also, Event speaker in the AIAA LA-LV 1/30 Dinner Meeting in the Proud Bird (<https://conta.cc/2LNY7p8>)

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

Author, Bestseller "The X-15 Rocket Plane, Flying the First Wings into Space"

Founder and President, Mach 25 Media (www.Mach25Media.com)

Writer, Photographer, and Communications Specialist in aerospace



(insert image)



Photo taken by Ms. Evans at 8:42 pm PDT on July 11th from Yuma, Arizona, on the way to Tucson for Spacefest. The crescent Moon is in the lower right, in the tree, with Venus toward the middle, and a tiny, nearly invisible, Mars to the left of that. The inset image (left) shows a close-up from that same photo that more clearly shows Venus, and the very faint Mars.



Venus as it was setting in the west behind the Marriott Starr Pass Resort in Tucson on July 17th at 8:27 pm PDT, in a very beautiful deep blue sky. (Credit: Ms. Michelle Evans)

Photo Diary: Spacefest and the July Moon-Venus-Mars Conjunction (Ms. Michelle Evans)



Marriott Starr Pass Resort in Tucson from Michelle's room there.



Ms. Michelle Evans (left) and Apollo 7's Walt Cunningham (right) in Spacefest.

Photo Diary: Spacefest and the July Moon-Venus-Mars Conjunction (Ms. Michelle Evans)



All the astronauts who were there at Spacefest.



All the female astronauts who were there at Spacefest.

Photo Diary: Spacefest and the July Moon-Venus-Mars Conjunction (Ms. Michelle Evans)



Astronaut Charlie Duke, Moonwalker on Apollo 14.



Baily Burns, a systems engineer from Paragon, with a skirt that is a reproduction of the parachute used to land the Perseverance Mars rover in February. The parachute (and skirt) is encoded with the message "Dare Mighty Things." ([Click to see the NASA publication](#))

RSVP and Information: (<https://conta.cc/3xp7ZuQ>)

AIAA LA-LV e-Town Hall Meeting 7/31 (Online on Zoom)
Saturday, 2021 July 31, 9AM PDT (US and Canada) (GMT -0700)

Design and Development of Lighter-Than-Air Systems

Making Balloons Fly and Float

by

Prof. Rajkumar S. Pant

Lighter-Than-Air Systems Laboratory, Aerospace Engineering Department
Indian Institute of Technology Bombay, Powai, Mumbai

An AIAA LA-LV Zoom Webinar / Online Section Meeting



(Left) Micro Airship @ IIT Bombay; (Middle) Mini Airship @ Pune; (Right) Macro Airship @ Manali

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

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

AIAA LA-LV e-Town Hall Meeting 8/7 (Online on Zoom)
Saturday, 2021 August 7, 10 AM PDT (US and Canada) (GMT -0700)

(Part I) (10:10 AM - 11:20 AM PDT (GMT -0700))

Countering Objections to Space Settlement

by

Mr. Al Globus

Contract software engineer, NASA Ames Research Center - Retired
AIAA Space Colonization Technical Committee
NSS Board of Directors

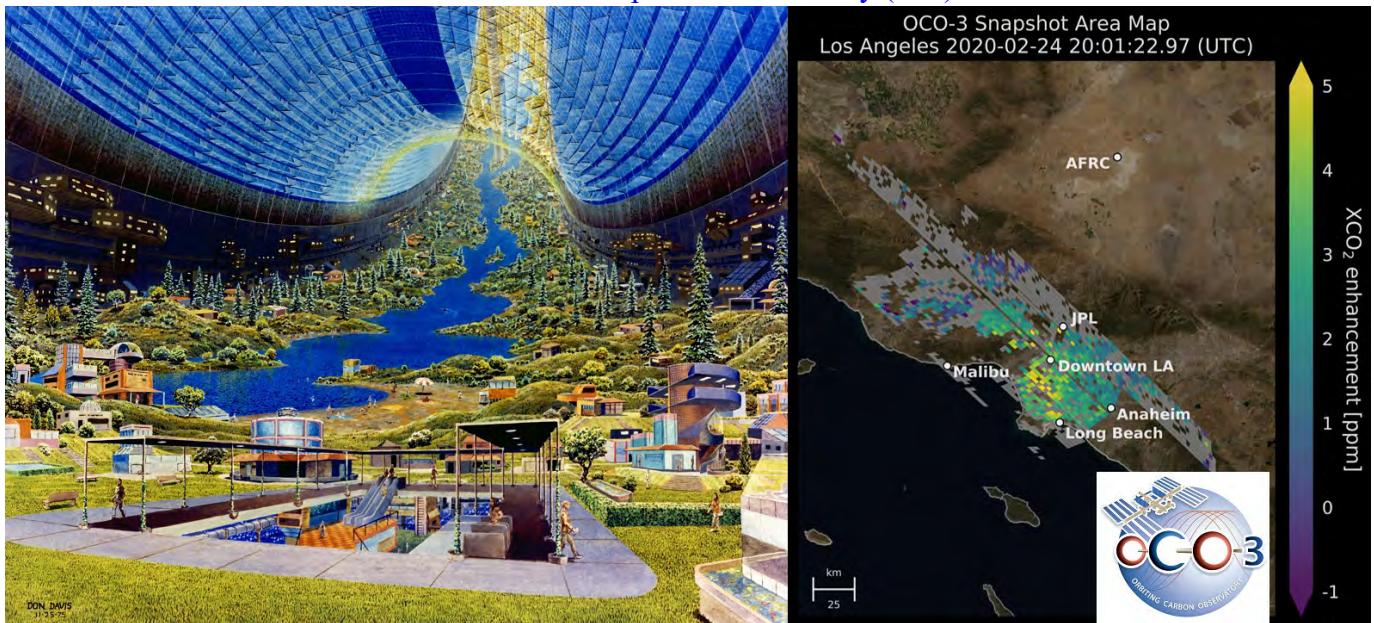
(Part II) (11:20 AM - 12:30 PM PDT (GMT -0700))

Urban-focused satellite CO₂ observations from the Orbiting Carbon Observatory-3: A first look at the Los Angeles megacity

by

Dr. Matthäus Kiel

Research Scientist
NASA's Jet Propulsion Laboratory (JPL)



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RSVP and Information: (<https://conta.cc/2SNw3J7>)

AIAA LA-LV e-Special Event 8/14 (Online on Zoom)

Saturday, 2021 August 14, 10 AM PDT (US and Canada) (GMT -0700)

AIAA LA-LV Space Philosophy Gathering 2021



*Mr. Dan Dumbacher
(Opening Remark)*



*Prof. Madhu Thangavelu
(Moderator)*



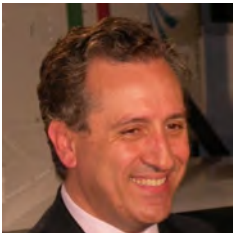
Mr. Luke Jerram



Dr. Jacques Arnauld



Dr. Mark Wagner



Dr. Gennaro Russo



Prof. Christopher Cokinos



Atty. Michelle Hanlon



Mr. John C. Mankins



Dr. David H. Levy



Mr. Henk Rogers



Ms. Britt Duffy Adkins



Ms. Melodie Yashar



Dr. Leslie Wickman



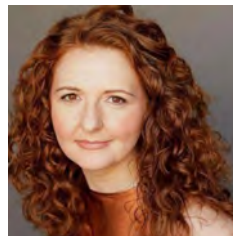
Mr. Frank White



Dr. Stan Rosen



Lawrence (Larry) Downing, DMin



Dr. Niamh Shaw



Ms. Ayse Oren



Prof. Wes Jones

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RSVP and Information: (<https://conta.cc/2TYveNV>)

AIAA LA-LV e-Special Meeting 8/21 (Online on Zoom)

Saturday, 2021 August 21, 10 AM PDT (US and Canada) (GMT -0700)

Happy Women's Equality Day !

AIAA LA-LV Celebrates the American History Month for Women, with Women Aerospace Professionals and a Featured Presentation "From Passenger to Pilot"



(Part I)

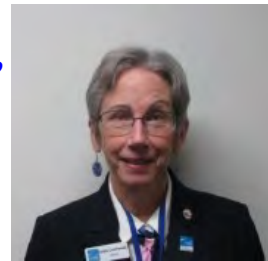
"From Passenger to Pilot"

by

Ms. Leslie Czechowski

Docent, Museum of Flight, Seattle

Volunteer, Kent Library



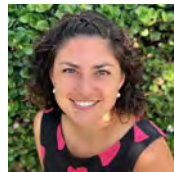
(Part II)

**Aerospace Women Professionals
Panel Discussion**



Ms. Marilee Wheaton (Moderator)

Exhibition and Special Briefings



Ms. Tanja Schroeder

"EnCorps and STEM Teachers Program"

(Part III)

**Early Career Panel for
Women Professionals**



Ms. Janet Grondin (Moderator)



Ms. Claudine Phaire



Dr. Claire Leon



Atty. Jennifer Perdigao



Dr. Anita Sengupta



Dr. Swati Saxena



Ms. Leslie Czechowski



Isis Ginyard

A rising junior at Woodward School
"Development of the Stella App"



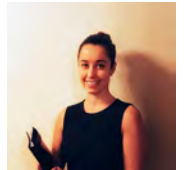
Ms. Kathleen Fredette



Ms. Janelle Wellons



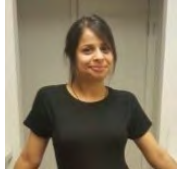
Dr. Aki Roberge



Ms. Laura Duffy



Ms. Marilyn McPoland



Ms. Niyati Chokshi

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RSVP and Information: (<https://conta.cc/3gMjNSg>)
AIAA LA-LV e-Town Hall Meeting 8/28 (Online on Zoom)
Saturday, 2021 August 28, 10 AM PDT (US and Canada)(GMT -0700)

(Part I: 10:10 AM - 11:40 AM PDT)

Deep Space Communications

by

Dr. Jon Hamkins

Chief Technologist of the Communications, Tracking, and Radar Division
NASA's Jet Propulsion Laboratory (JPL)

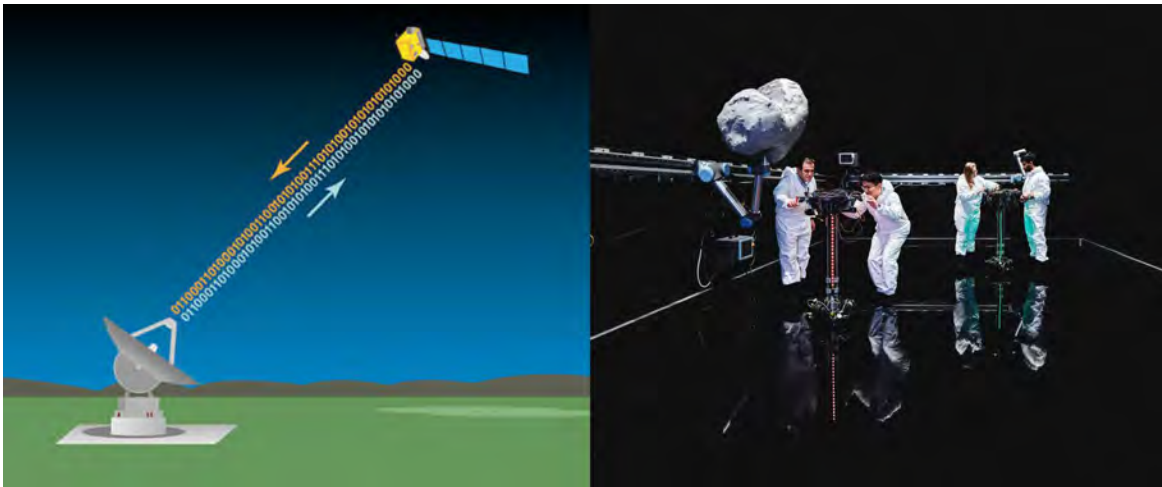
(Part II: 11:40 AM - 1:10 PM PDT)

Aerospace Robotics and Autonomy Research at CalTech (How to combine Machine Learning and Artificial Intelligence (ML/AI) with GNC)

by

Prof. Soon-Jo Chung

Bren Professor of Aerospace and Control and Dynamical Systems
Department of Computing + Mathematical Sciences (CMS)
Department of Aerospace/ Graduate Aerospace Laboratories (GALCIT)
California Institute of Technology
JPL Research Scientist
NASA Jet Propulsion Laboratory (JPL)
California Institute of Technology



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RSVP and Information: (<https://conta.cc/361vdvc>)

AIAA LA-LV e-Town Hall Meeting 9/11 (Online on Zoom)

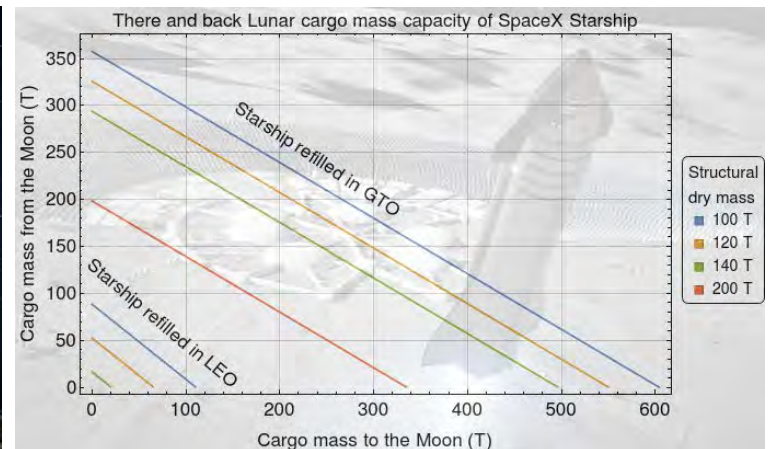
Saturday, 2021 Septemebr 11, 10 AM PDT (US and Canada) (GMT -0700)

The SpaceX Starship is a very big deal and Countering Misconceptions in Space Journalism

by

Dr. Casey Handmer

Physicist (PhD Caltech) and Software Engineer



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RSVP and Information: (<https://conta.cc/3yh7t25>)

AIAA LA-LV e-Town Hall Meeting 9/18 (Online on Zoom)

Saturday, , 2021 September 18, 10 AM PDT (US and Canada) (GMT -0700)

(Part I: 9 AM PDT (GMT-0700))

Space Technology & RADAR Applications

by

Dr. Sudhir Kumar Chaturvedi

Associate Professor and Placements Internship Coordinator,
Department of Aerospace Engineering, UPES Dehradun, India

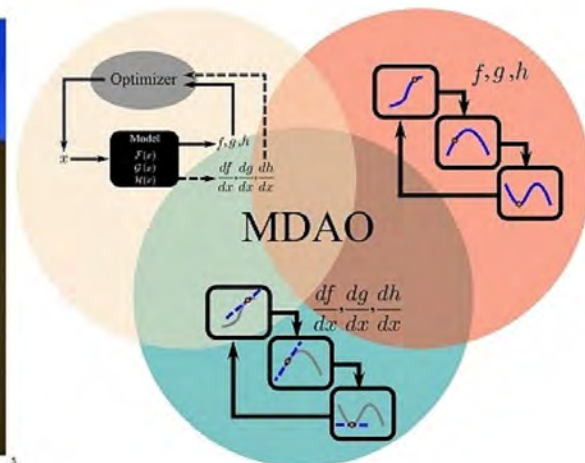
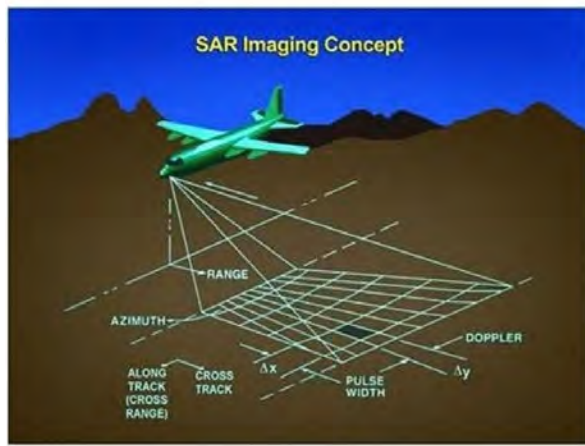
(Part II: 10:30 AM PDT (GMT-0700))

MDAO models for Conceptual Designs

by

Mr. Jim Guglielmo

AIAA Associate Fellow
Manager of the Vehicle Design,
Analysis and Optimization Group,
Boeing Research & Technology



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