



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

Newsletter



NASA Remembers Michael Collins

Statements on Passing of Michael Collins

April 28, 2021, Release 21-047

<https://www.nasa.gov/press-release/statements-on-passing-of-michael-collins>

“Today the nation lost a true pioneer and lifelong advocate for exploration in astronaut Michael Collins. As pilot of the Apollo 11 command module – some called him ‘the loneliest man in history’ – while his colleagues walked on the Moon for the first time, he helped our nation achieve a defining milestone. He also distinguished himself in the Gemini Program and as an Air Force pilot.

“Michael remained a tireless promoter of space. ‘Exploration is not a choice, really, it’s an imperative,’ he said. Intensely thoughtful about his experience in orbit, he added, ‘What

would be worth recording is what kind of civilization we Earthlings created and whether or not we ventured out into other parts of the galaxy.’

“His own signature accomplishments, his writings about his experiences, and his leadership of the National Air and Space Museum helped gain wide exposure for the work of all the men and women who have helped our nation push itself to greatness in aviation and space. There is no doubt he inspired a new generation of scientists, engineers, test pilots, and astronauts.

“NASA mourns the loss of this accomplished pilot and astronaut, a friend of all who seek to push the envelope of human potential. Whether his work was behind the scenes or on full view, his legacy will always be as one of the leaders who took America’s first steps into the cosmos. And his spirit will go with us as we venture toward farther horizons.”

The following is a statement from the Collins family:

“We regret to share that our beloved father and grandfather passed away today, after a valiant battle with cancer. He spent his final days peacefully, with his family by his side. Mike always faced the challenges of life with grace and humility, and faced this, his final challenge, in the same way. We will miss him terribly. Yet we also know how lucky Mike felt to have lived the life he did. We will honor his wish for us to celebrate, not mourn, that life. Please join us in fondly and joyfully remembering his sharp wit, his quiet sense of purpose, and his wise perspective, gained both from looking back at Earth from the vantage of space and gazing across calm waters from the deck of his fishing boat.”

For more information about Collins and his NASA career, visit: <https://www.nasa.gov/michael-collins/>

1 NASA Remembers Michael Collins	May 2021	18 Morf3D to reinvent the future with launch of 90,000 sq. ft. Applied Digital Manufacturing Center
2 Remembering Michael Collins	Click title to go to article	19 Student-Led Moon Dust Shield Team Named Finalist in NASA Competition
3 Space Shuttle Columbia, A Personal Journey		20 Countering Objections to Space Settlement
4 Outward Odyssey Authors Remembering STS-1		Gallery, Poetry, and Upcoming Events
5 Weighing in on Space Shuttle legacy (STS-1 40th Anniversary on 4/10)		72 Photography Gallery: Dr. Robert Q Fugate and Ms. Michelle Evans
6 Touchdown! Landing the first Shuttle Mission		77 Poetry by Steven Gelb
7 60 Years Ago: Alan Shepard Becomes the First American in Space		78 Mars Atmosphere and Climate Past Present and Future (2021 May 15)
8 As Artemis Moves Forward, NASA Picks SpaceX to Land Next Americans on Moon		79 AIAA LA-LV e-Happy Hour in a virtual Space Station ! (2021 May 20)
9 Practical Quantum Computing with D-Wave by Dr. Victoria Goliber (4/15)		80 Space Nuclear Power & Propulsion (2021 May 22)
10 AIAA LA-LV New Space mini-Conference 2021 (2021 April 17)		81 The Challenges of Landing Perseverance on Mars (2021 May 27)
11 AIAA LA-LV Aero Alumni Meeting (2021 April 21)		82 ANSYS Digital Transformation through MBSE Accidents Happens (6/5)
12 AIAA LA-LV Earth Day Celebration 2021 (2021 April 24)		83 Aerospace Projects in India: Recent Developments and Future Plans (6/12)
13 AIAA LA-LV Award Announcement and Ingenuity Talk (2021 May 1)		84 The Tuskegee Airmen, Juneteenth, African American Professionals Event (6/19)
14 High school junior's consumer seismometer delivers low-cost earthquake early warning		85 Planetary Defense Workshop with Asteroid Exploration Updates (6/26)
15 Cancel the drag	To send comments or submissions, or to purchase advertising, please:	contact: AIAA LA LV Newsletter Editor, editor.aiaalav@gmail.com
16 A Cloud Black Box That Gentlemen Do Not		Copyright © 2021 American Institute of Aeronautics and Astronautics, Los Angeles-Las Vegas Section
17 The case for restoring US nukes in East Asia		



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

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

Remembering Michael Collins

with a note from Dr. Jeff Puschell (AIAA Fellow, AIAA LA-LV Section Chair)

by Michelle Evans (AIAA Distinguished Lecturer | Author, "The X-15 Rocket Plane, Flying the First Wings into Space")



From Dr. Jeff Puschell (AIAA Fellow, AIAA LA-LV Section Chair): (<https://www.aiaa-lalv.org/member-spotlight-march-2-2020-on-dr-jeffrey-puschell/>)

"I met Michael Collins in a very brief encounter. He was chatting with a group of folks at the AIAA Space Forum years ago. I knew most of the people in the group and they kindly took a moment to introduce me to Michael. We had a nice chat for a few minutes before we all went our separate ways to different meetings. This also illustrated one of the benefits of AIAA membership."



Ms. Michelle Evans (AIAA Distinguished Lecturer): (<https://www.aiaa-lalv.org/september-28-2020-aiaa-member-spotlight-on-michelle-evan/>)



From right to left: Michael Collins, Cherie Evans, Walt Cunningham (Apollo 7), and Michelle Evans. (Courtesy of Ms. Michelle Evans)

Mike Collins was the unsung hero of the Apollo 11 mission. Out of the three crew members, he was the one that had to stay behind in lunar orbit to make sure that Neil and Buzz would have a way home. Because of that, he got within a few miles of the lunar surface, but never actually got to walk there, and that also left him as the least known of what is the most famous crew to ever fly a mission into space.

In July 1969 there were only three major television networks broadcasting in America. All three of them showed only one thing on 20 July, and that was every moment of the Moon landing. A lot of that coverage was done through various simulators since we didn't have live downlink. I always found it rather funny to watch newscasters trying to use models to explain the events that were happening a quarter million miles from home. They were often clumsy, and many of those models ended up broken on their desks.

Once on the surface, and after the hatch opened so Neil could start down the ladder, the simulator switched to a full scale model of the Lunar Module with some guy in a Moonsuit trying to look like he was in 1/6th gravity as he descended to the sound stage floor. On the actual Moon,

(*Continued on Page 21*)

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

Business card, quarter page, half page, and full page.

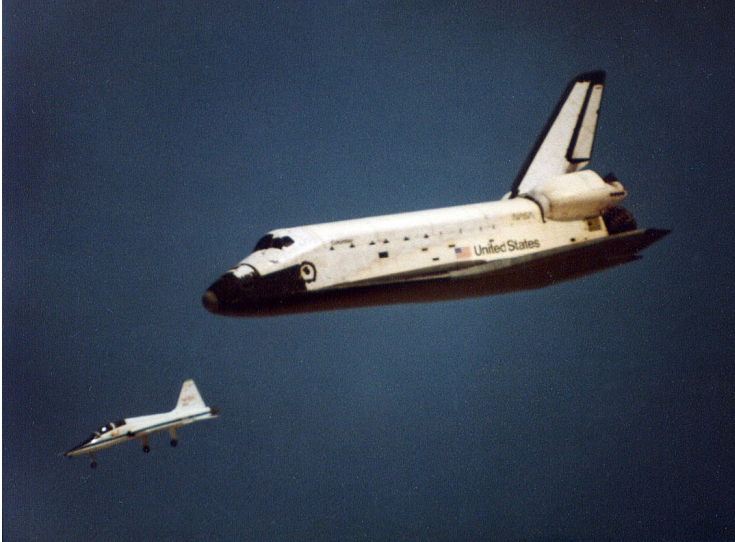
The newsletter has over 8,000 subscribers, which is growing.

To inquire about purchasing advertising, email Newsletter Editor at

editor.aiaalalv@gmail.com

Space Shuttle Columbia, A Personal Journey

by Michelle Evans (AIAA Distinguished Lecturer | Author, "The X-15 Rocket Plane, Flying the First Wings into Space")



The Columbia sails past as it nears landing at the end of the first mission of the Space Shuttle program, STS-1, on 14 April 1981.

In response to the fact that we are celebrating the 40th anniversary of the first flight of the Space Shuttle, I would like to share some of my personal experiences with regard to Orbiter Vehicle-102, also known as Space Shuttle Columbia.

It took nearly 5 years to build the vehicle and prepare her for the first of 28 launches, nearly half of which were dedicated science missions. The name Columbia has a rich history of exploration, dating back to the late 1700s, including the first sailing ship to explore the Columbia River, the *Columbia Rediviva* in 1792; and a Naval frigate that was one of the first to circumnavigate the world, the *USS Columbia* in 1836. Columbia was also the name of the Command Module on Apollo 11, the first lunar landing.

As for the Space Shuttle Columbia, she was originally supposed to fly in 1979, but technological delays put that off until early 1981. Most people recall the difficulties encountered with the heat tiles, but there was also a significant delay with development of the Space Shuttle Main Engines, now known as the RS-25.

Once those problems were sorted out and corrected, the launch finally appeared imminent. Less than a month before launch, during a Countdown Demonstration Test, tragedy first befell the vehicle when three men were killed during operations on the launch pad. They were

overcome by nitrogen while working in the aft body of the Orbiter. It is little remembered today, but I would like to dedicate this article to the memories of John Bjornstadt, Frank Cole, and Nick Mullon.



Bob Crippen speaks to the crowd with his commander, John Young, close by.

The launch was finally ready to happen on 10 April 1981, but was scrubbed at T-minus 31 seconds because the five computers onboard the Shuttle could not all sync up and talk to each other. This was all taken in stride by the crew, Commander John Young and pilot Robert Crippen.

Two days later, on Sunday, 12 April, at 7:00 am and 3 seconds Eastern Time, the three Space Shuttle Main Engines on Columbia, and two Solid Rocket Boosters attached to the External Tank, pushed the vehicle off Launch Pad 39A at the Kennedy Space Center in Florida. According to NASA, the T-0 point was actually at exactly 7:00 am, but for some bizarre reason, even though the countdown ended at zero, the actual launch didn't occur until T+3 seconds. (This was rectified on future missions so that T-0 was the actual liftoff.) About 10 minutes later, Columbia was on orbit. The 48-hour delay was actually serendipitous in that the launch also marked the 20th anniversary since the first man flew into space, when Yuri Gagarin lifted-off on 12 April 1961 for a single Earth orbit from the Soviet Union.

(Continued on Page 22)

Outward Odyssey Authors Remembering STS-1

by speakers/panelists for the AIAA LA-LV April 10, 2021 event | also authors of the Outward Odyssey series

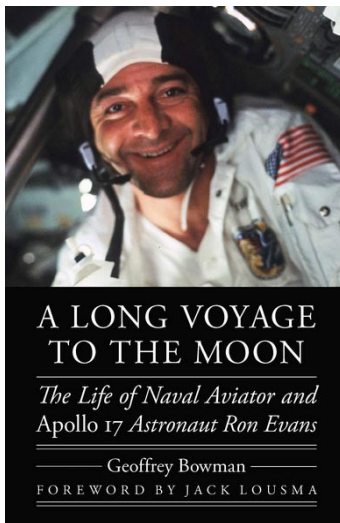
<https://www.aiaa-lalv.org/april-10-2021-sts-1-40th-anniversary-celebration-outward-odyssey-authors-present-columbia-and-the-legacy-of-the-space-shuttle-program/>

by **Geoffrey Bowman**

I probably share a collective memory of STS-1 with other space enthusiasts of a certain age: delight that the long drought was over, coupled with concern that this looked like the riskiest mission for a long time... maybe the riskiest ever. Outwardly I was thinking "It'll be OK. NASA will get it right!" Inwardly I had nagging concerns. "Will it really be OK?"

Space-watchers had been spoiled by the punctuality of Apollo launches: no mission had ever suffered a scrub on launch-day. That probably contributed to a degree of complacency when I arranged a visit to London with my girlfriend. The timings were perfect: I would watch the launch on April 10, follow Columbia's return on April 12, then we would take the car-ferry to Scotland on April 14. What could possibly go wrong?

Scrub! I hadn't seen that coming! The launch was pushed back two days and my plans started to disintegrate. Yes, I got to watch the launch live on April 12 and was enthralled by the spectacle. But two days later, instead of being glued to live TV of the re-entry and landing, I was listening to my crackly car radio on the road to the ferryport. I told my passenger that no other power on the planet could have made me miss the landing on TV. We still broke up five months later.

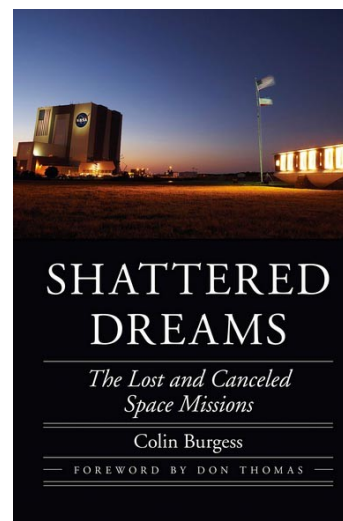


About the Author: Geoffrey Bowman, Author, "A Long Voyage to the Moon."

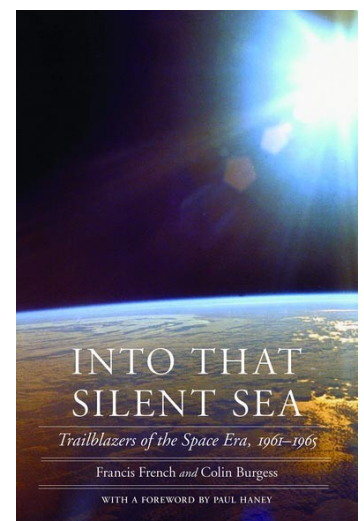
by **Colin Burgess**

THE MAIDEN ORBITAL FLIGHT—As our calendars flipped open up to reveal April 1981, my thus-far unshakeable belief in NASA's competence and can-do spirit was being sorely tested. I had always been impressed by the space agency's ability to overcome problems and return astronauts back home from a potentially lethal environment. Despite the ongoing saga of Apollo 13, I had the utmost faith—perhaps a little naively—in NASA, its engineers and astronauts to turn a potential tragedy into a story of incredible survival. It therefore came as no surprise to me when the exhausted crew splashed down and were safely recovered after their drama-filled return.

And then, on April 12, 1981—exactly twenty years after Yuri Gagarin became the world's first spacefarer—an orbiter named Columbia sat on the launch pad, ready to take its maiden flight into the heavens, and I have to admit I was scared. As events unfolded that day I marveled at the sheer bravery of John Young and Bob Crippen in taking on such a calculated risk. As the main engines roared into life I would have held my breath and the SRBs then kicked in and Columbia began her painfully slow ascent into the skies over Florida. When the orbiter safely reached orbit my earlier faith in NASA had been truly validated, and I could now look forward to the fulfillment of all that the remarkable shuttle program could provide.



About the Author: Colin Burgess, Author, "Shattered Dreams." Co-Author, "Into That Silent Sea," "In the Shadow of the Moon," and "Fallen Astronauts."



([Continued on Page 27](#))

Weighing in on Space Shuttle legacy

(based on the AIAA LA-LV STS-1 40th Anniversary event on 2021 April 10)

by Larry Grooms, special to Aerotech News

<https://www.aerotechnews.com/blog/2021/04/18/weighing-in-on-space-shuttle-legacy/> (2021 April 18)

<https://www.aerotechnews.com/blog/2021/04/19/aerotech-news-digital-edition-april-16-2021/> (2021 April 16)



The Space Shuttle Columbia begins a new era of space transportation when it lifts off from NASA Kennedy Space Center. The reusable Orbiter, its two fuel tanks and two Solid Rocket Boosters has just cleared the launch tower. Aboard the spacecraft are Astronauts John W. Young, Commander, and Robert L. Crippen, Pilot. (NASA photograph)

Marking the 40th anniversary of the first space shuttle orbital launch and landing, the Los Angeles–Las Vegas Section of the American Institute of Aeronautics and Astronautics convened an online panel of authors and editors to offer their evaluations on the Space Shuttle era.

The panelists, contributing authors or editors for the University of Nebraska's Outward Odyssey books series, offered widely ranging and often divergent thoughts, memories and observations on the promise and performance of [the Space Shuttle program](#).

Moderator David Hitt, co-author of two books, *Homesteading Space: The Skylab Story*, and *Bold They Rise: The Space Shuttle Early Years*, worked as a contractor at NASA's Marshall Space Flight Center beginning in 2002. He currently supports the center's Human Exploration Development and Operations office, responsible for human spaceflight efforts ranging from science operations on the International Space Station to development of future space habitats.

Relating though an exclusive photographic display, characterized as a Personal Journey, aerospace writer, photographer and communications specialist Michelle Evans, founder and president of Mach 25 Media, led off the dialogue with detailed presentation on her book, *The X-15 Rocket Plane, Flying the First Wings into Space*.

Lifelong space enthusiast Geoffrey Bowman, a retired lawyer living in Belfast, Northern Ireland, remembers the flights of Yuri Gagarin and [Alan Shepard](#), and has fond and vivid memories of the Apollo missions. He saw the Saturn rocket launch of Apollo-Soyuz in July 1975. Having contributed two chapters to Outward Odyssey's *Footprints in the Dust*, Bowman has submitted the manuscript for a biography of Apollo 17 astronaut Ron Evans. With the working title: *A Long Voyage to the Moon*, the book is due to be published later this year.

Colin Burgess wrote more than 30 books on human space exploration, with titles including: *Selecting the Mercury Seven – The Search for America's First Astronauts*; *Teacher in Space – Christa McAuliffe* and [the Challenger Legacy](#); *Fallen Astronaut*, and most recently, *Shattered Dreams*. Residing in Sydney, Australia, Burgess mentors new spaceflight authors, guiding them through the publication process.

Jay Chladek is a spaceflight historian and a regular contributor to the online forum collectSPACE. In his Outward Odyssey volume *Outposts on the Frontier*, Chladek documents the historical tapestry of the people, the early attempts at space station programs, and how astronauts and engineers contributed to and shaped the International Space Station.

It might be said that Melvin Croft brought to the panel a perspective of someone who bridges the gap between the soil and space. With 40 years of experience as a professional geologist, working in industry for 27 years and teaching geology in college for a dozen more, Croft has made human space flight his avocation since the beginning, having met many astronauts and cosmonauts. Collaborating with John Youskauskas, Mel is working on another addition to the Outward Odyssey book series, chronicling the story of extravehicular activity.

Francis French brings international experience in relating science, engineering, music, astronomy, art, and wildlife to general audiences through classes, workshops, public speaking, and television and documentary productions. He is the author of bestselling history books, including, *In the Shadow of the Moon* for the Outward Odyssey series.

(Continued on Page 32)

Touchdown! Landing the first Shuttle Mission

by Larry Grooms, special to Aerotech News

<https://www.aerotechnews.com/blog/2021/04/17/touchdown-landing-the-first-shuttle-mission/> (2021 April 17)

<https://www.aerotechnews.com/blog/2021/04/19/aerotech-news-digital-edition-april-16-2021/> (2021 April 16)



Space Shuttle Columbia arrived on a trailer after a 36-mile journey from the Rockwell International plant in Palmdale, through Lancaster then to Edwards. The orbital vehicle was delivered to NASA's Dryden facility to be mated with its Boeing 747 carrier aircraft. (NASA photograph)

Forty years ago this month, more than a quarter-million human beings came to Edwards Air Force Base in Southern California to witness and cheer the first landing of a spaceship on Planet Earth. And around the world, hundreds of millions more earthlings watched it on television.

Jammed shoulder-to-shoulder on viewing sites along the eastern shoreline of Rogers Dry Lake, eyes strained to see the Space Shuttle Orbiter Columbia, and jaws dropped at the unexpected double crack of a powerful sonic boom, the space shuttle's percussive overture. That signature sonic blast was only the first in a string of historic firsts that changed the world, the nation, and Southern California's Aerospace Valley where NASA's Space Shuttle era was born, after nearly two decades of gestation in the dry desert air.

The April 14, 1981, landing at NASA's Dryden Flight Research Center on Edwards AFB, came just two days, six hours and 20 minutes after Columbia was launched into orbit from the Kennedy Space Center at Cape Canaveral, Fla. After 36 Earth orbits, mission commander John W. Young and pilot Robert L. Crippen began Columbia's descent as the world held its breath.

It wasn't just thrills and drama that lured the multitudes to Edwards that mid-April morning. According to archival news reports, the Space Shuttle's first launch and landing ended what was seen as a discouraging American absence in space after the end of the Apollo missions. The impromptu Super Bowl-sized tailgate party on the dry lakebed could not be ignored. America's space program had roared back bigger and better, with overwhelming public pride and support.

In a grudgingly left-handed salute to NASA and the new administration of President Ronald Reagan, TIME magazine's January cover story opined:

"Like the U.S., the space shuttle Columbia is looking up as the year begins.

"It was mighty considerate of NASA to roll out Columbia a full three months before it shoots into the future. Everyone needs a lift in January, and here, magically, comes this stark quartet of domes and turrets rising like a restored castle out of the Florida flats. The timing is impeccable. As the Reagan Administration lumbers into place, so too this other new machine—huge, untried, ambitious (albeit with limited maneuverability); designed to aid national defense, to boost Big Business, to restore U.S. eminence in a domain once its own; a reviver of old dreams; a boon to upward mobility. The same question applies to both vehicles: Will they fly?

"In Columbia's case the question is a bit needling. A monument to Murphy's Law, the great white Batmobile that will be piloted by Astronauts John Young and Robert Crippen is already two years behind its timetable and \$3.6 billion over budget. Only a year ago workmen had diagnosed the ship's ailment as "smallpox," a reference to the holes left in its outer shell when heat-dissipating tiles became unglued. At one time or another, the entire project became unglued. Perhaps it was prophetic that the task force proposing the space shuttle back in 1969 was headed by Vice President Spiro Agnew. In any case, Columbia offers in its fashion a symbol not only of the Reagan Administration, but of the U.S. as it rolls into the 1980s—way behind schedule, well over budget, its hopes, as ever, riding on machines.

[\(Continued on Page 33\)](#)

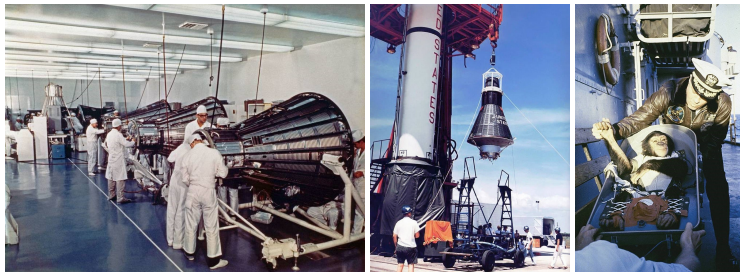
60 Years Ago: Alan Shepard Becomes the First American in Space

May 5, 2021 <https://www.nasa.gov/image-feature/60-years-ago-alan-shepard-becomes-the-first-american-in-space>



John H. Glenn, left, Virgil I. "Gus" Grissom, and Alan B. Shepard, the astronauts selected for the first suborbital mission.

I was ten. Had completely missed Apollo. Had spent the last two years reading Shuttle books which all told me it was supposed to be flying already. Up early that Sunday, fiddling with rabbit ears on the basement TV. Finally! With the first launch imminent, my generation's space program could begin at last. I parked in front of the screen with my space Legos and waited.



Left: Workers assemble Mercury capsules at the McDonnell Aircraft plant in St. Louis. Middle: Ground crews lift the Mercury capsule for chimpanzee Ham's flight to the top of the Redstone rocket. Right: Chimpanzee Ham on the prime recovery ship U.S.S. Donner following his suborbital mission.

The Space Task Group (STG) at NASA's Langley Research Center in Hampton, Virginia, initiated Project Mercury in 1958 with three goals: orbiting a crewed spacecraft, investigating man's ability to function in space, and safely recovering both spacecraft and crew member. NASA contracted the McDonnell Aircraft Corporation of St. Louis to build the Mercury spacecraft. Initial plans called for up to seven early suborbital flights launched on Redstone rockets to test the single-seat spacecraft, followed by Earth orbital missions using the more powerful Atlas booster. After some early launch failures, the first successful test flight of the Mercury spacecraft without an astronaut on board took place in December 1960, launched on a suborbital flight atop a Redstone rocket.



Left: Group photo of the Mercury 7 astronauts. Middle: The Mercury 7 astronauts pose in front of a Mercury capsule. Right: Leader of the Space Task Group Robert R. Gilruth, right, with the Mercury 7 astronauts.

In parallel with Mercury spacecraft development, NASA [selected its first group of astronauts](#) on April 9, 1959. The group consisting of [M. Scott Carpenter](#), [L. Gordon Cooper](#), [John H. Glenn](#), [Virgil I. "Gus" Grissom](#), [Walter M. Schirra](#), [Alan B. Shepard](#), and [Donald K. "Deke" Slayton](#) called themselves the Mercury 7 astronauts. They began intensive training in the hope of becoming the first human in space. On Jan. 19, 1961, STG leader [Robert R. Gilruth](#) informed the group that Shepard would fly the first suborbital mission, Grissom the second, with Glenn serving as a back up to both of them. To the public, NASA revealed only that one of the three men would make the first flight, with the actual individual made known only close to the launch. Before the first astronaut flight, NASA tested the Redstone rocket and the Mercury capsule by flying chimpanzee Ham on an identical suborbital mission on Jan. 31. Although the flight was mostly successful and the U.S. Navy recovered Ham in excellent shape, a problem with an electrical relay in the Redstone rocket caused NASA to

(Continued on Page 38)

As Artemis Moves Forward, NASA Picks SpaceX to Land Next Americans on Moon

Apr 16, 2021, RELEASE 21-042

<https://www.nasa.gov/press-release/as-artemis-moves-forward-nasa-picks-spacex-to-land-next-americans-on-moon>



Illustration of SpaceX Starship human lander design that will carry the first NASA astronauts to the surface of the Moon under the Artemis program. Credits: SpaceX

NASA is getting ready to send astronauts to explore more of the Moon as part of the [Artemis](#) program, and the agency has selected SpaceX to continue development of the first commercial human lander that will safely carry the next two American astronauts to the lunar surface. At least one of those astronauts will make history as the first woman on the Moon. Another goal of the Artemis program includes landing the first person of color on the lunar surface.

The agency's powerful Space Launch System rocket will launch four astronauts aboard the Orion spacecraft for their multi-day journey to lunar orbit. There, two crew members will transfer to the SpaceX human landing system (HLS) for the final leg of their journey to the surface of the Moon. After approximately a week exploring the surface, they will board the lander for their short trip back to orbit where they will return to Orion and their colleagues before heading back to Earth.

The firm-fixed price, milestone-based contract total award value is \$2.89 billion.

"With this award, NASA and our partners will complete the first crewed demonstration mission to the surface of the Moon in the 21st century as the agency takes a step forward for women's equality and long-term deep space exploration," said Kathy Lueders, NASA's associate administrator for Human Explorations and Operations Mission Directorate. "This critical step puts humanity on a path to sustainable lunar exploration and keeps our eyes on missions farther into the solar system, including Mars."

SpaceX has been working closely with NASA experts during the HLS base period of performance to inform its lander design and ensure it meets NASA's performance requirements and human spaceflight standards. A key tenet for safe systems, these agreed-upon standards range from areas of engineering, safety, health, and medical technical areas.

"This is an exciting time for NASA and especially the Artemis team," said Lisa Watson-Morgan, program manager for HLS at NASA's Marshall Space Flight Center in Huntsville, Alabama.



<https://youtu.be/y-sA3R4MWjA>

"During the Apollo program, we proved that it is possible to do the seemingly impossible: land humans on the Moon. By taking a collaborative approach in working with industry while leveraging NASA's proven technical expertise and capabilities, we will return American astronauts to the Moon's surface once again, this time to explore new areas for longer periods of time."

SpaceX's HLS Starship, designed to land on the Moon, leans on the company's tested Raptor engines and flight heritage of the Falcon and Dragon vehicles. Starship includes a spacious cabin and two airlocks for astronaut moonwalks. The Starship architecture is intended to evolve to a fully reusable launch and landing system designed for travel to the Moon, Mars, and other destinations.

The HLS award is made under the [Next Space Technologies for Exploration Partnerships \(NextSTEP-2\)](#) Appendix H Broad Agency Announcement (BAA).

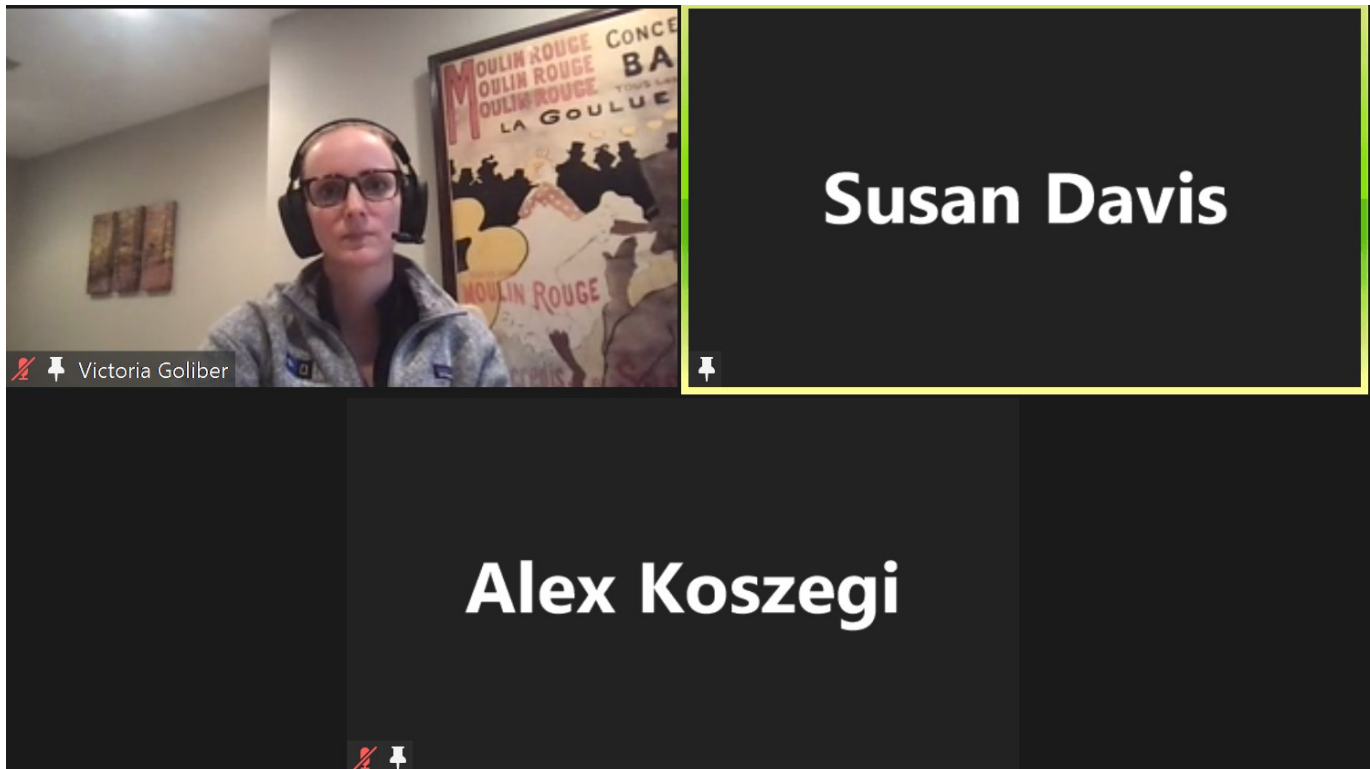
In parallel with executing the Appendix H award, NASA intends to implement a competitive procurement for sustainable crewed lunar surface transportation services that will provide human access to the lunar surface using the Gateway on a regularly recurring basis beyond the initial crewed demonstration mission.

With NASA's [Space Launch System](#) rocket, [Orion](#) spacecraft, HLS, and the [Gateway](#) lunar outpost, NASA and its commercial and international partners are returning to the Moon for scientific discovery, economic benefits, and inspiration for a new generation. Working with its partners throughout the Artemis program, the agency will fine-tune precision landing technologies and develop new mobility capabilities to enable exploration of new regions of the Moon. On the surface, the agency has proposed building a new habitat and rovers, testing new power systems and more. These and other innovations and advancements made under the Artemis program will ensure that NASA and its partners are ready for human exploration's next big step—the exploration of Mars.

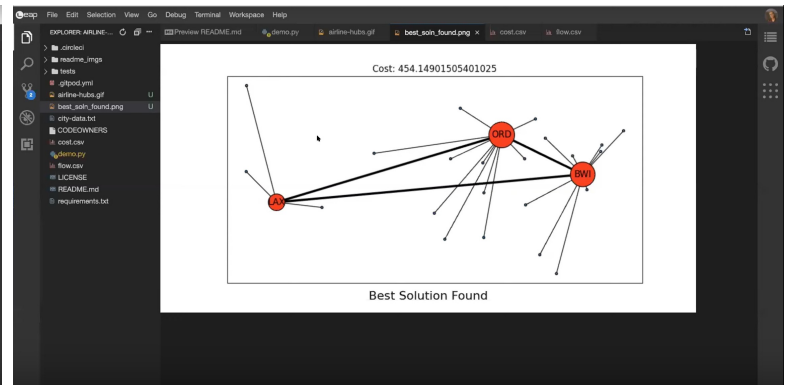
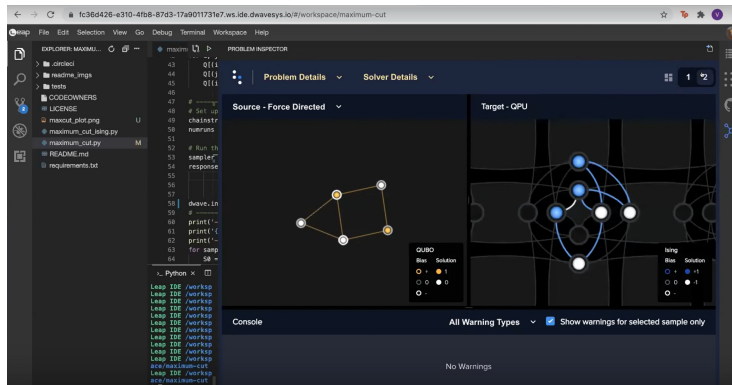
For more information about the human landing system, visit: <https://www.nasa.gov/content/humans-on-the-moon-0>

Practical Quantum Computing with D-Wave by Dr. Victoria Horan Goliber (2021 April 15)

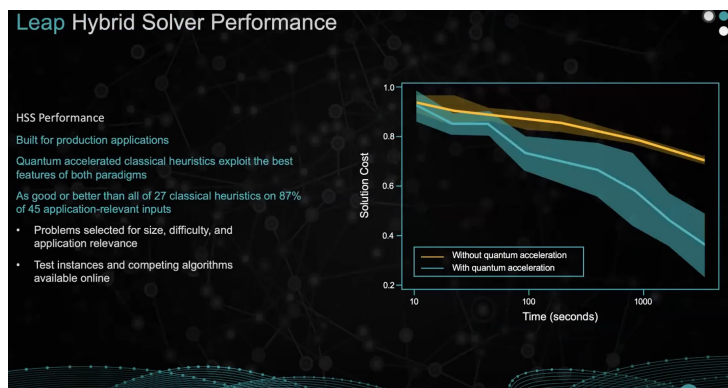
<https://www.aiaa-lalv.org/april-15-2021-practical-quantum-computing-with-d-wave-by-dr-victoria-horan-goliber/>



Dr. Victoria Goliber (Event Speaker) listening to and answering questions during the Q&A session, with the moderation by Ms Susan Davis (D-Wave Market Director), and the support from Ms. Alex Koszegi (D-Wave).



Dr. Victoria Goliber doing a live demo using a D-Wave Annealing Quantum Computer (on cloud) on an Airline Hub routing optimization.



Dr. Victoria Goliber showing the Quantum Advantage of the D-Wave Annealing Quantum Computer, and the industry trends.

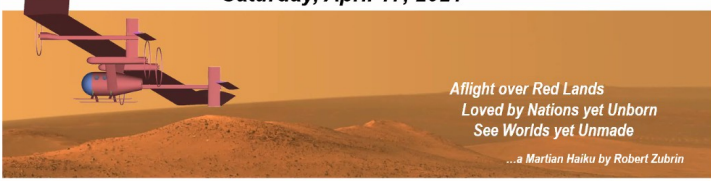
AIAA LA-LV New Space mini-Conference 2021 (2021 April 17)

<https://www.aiaa-lalv.org/2021-april-17-aiaa-la-lv-new-space-mini-conference-2021-2/>

Update of ASMI talk plus certain details

The Raymer Manned Mars Airplane: Overview & Design Integration

AIAA LA LV New Space Mini-Conf 2021
Saturday, April 17, 2021



*Alflight over Red Lands
Loved by Nations yet Unborn
See Worlds yet Unmade*
...a Martian Haiku by Robert Zubrin

Overview: Daniel P. Raymer, Ph.D.
President, Conceptual Research Corporation

Performance: Joabe Marcos de Souza
University of São Paulo (Brazil)


Cabin Layout & Human Factors: Jaspreet Singh
Vehicle Designer (India)

Interior Design & Renderings: Aviv Levy
President, Aviv Innovations (Israel)

Copyright C 2021 by D. P. Raymer All Rights Reserved

Including technical contributions by:

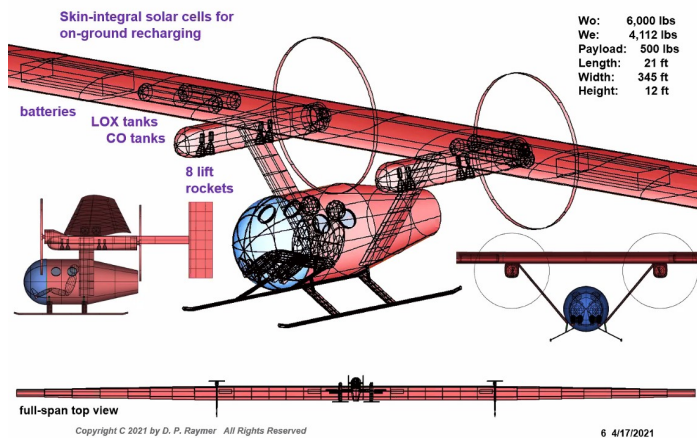
- James French
- Felix Finger
- Arturo Gómez
- Ramlingam
- Gyanasampath Pillai
- Matheus Monjon
- Jean-Francois Clavreul



Dan Raymer

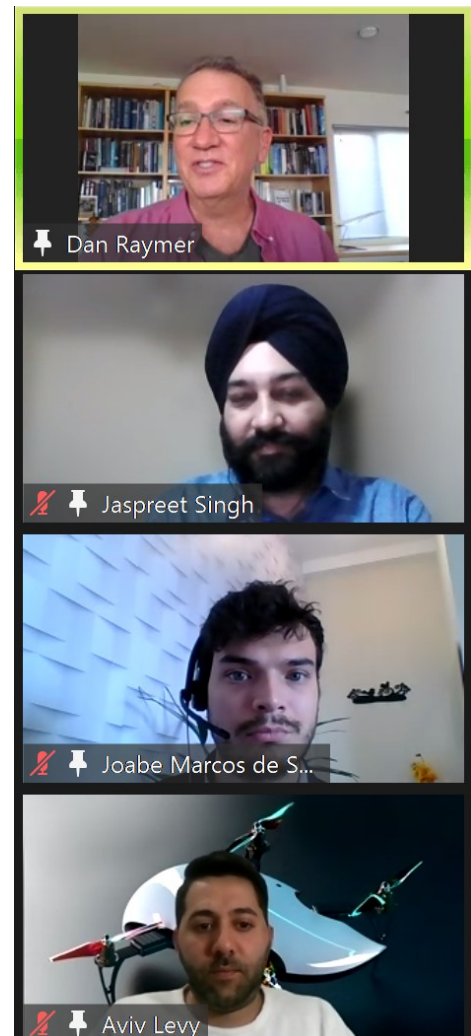
Dr. Dan Raymer (AIAA Fellow, Keynote Speaker) opening the event and showing the Raymer Manned Mars Plane (RMMP) he designed, and introducing the 3 speakers volunteering in the project and the names of the other volunteers/collaborators.

Design Features



Raymer Manned Mars Plane

CAD Rendering by Jean-Francois Clavreul



Dr. Dan Raymer and the 3 speakers-volunteers taking turns talking about the designs, and showing some artist's view of RMMP on Mars!
(Continued on Page 40)

AIAA LA-LV Aero Alumni Meeting (2021 April 21)



aiaa new space mini conference 2021

RMMP- Mars Atmosphere

- Mars atmosphere was modeled according to equation below [1]:

$$\begin{aligned} \text{For } h > 7000: \quad & \begin{cases} T = -23.4 - 0.00222 * h \\ p = 0.699 * e^{-0.00009 * h} \\ \rho = \frac{p}{(0.1921 * (T + 273.1))} \end{cases} \\ \text{For } h < 7000: \quad & \begin{cases} T = -31 - 0.000998 * h \\ p = 0.699 * e^{-0.00009 * h} \\ \rho = \frac{p}{(0.1921 * (T + 273.1))} \end{cases} \end{aligned}$$

Where: ρ = density (kg/m³)
 p = pressure (Pa)
 T = temperature (°C)
 h = altitude (m)

- Data for a surface level:

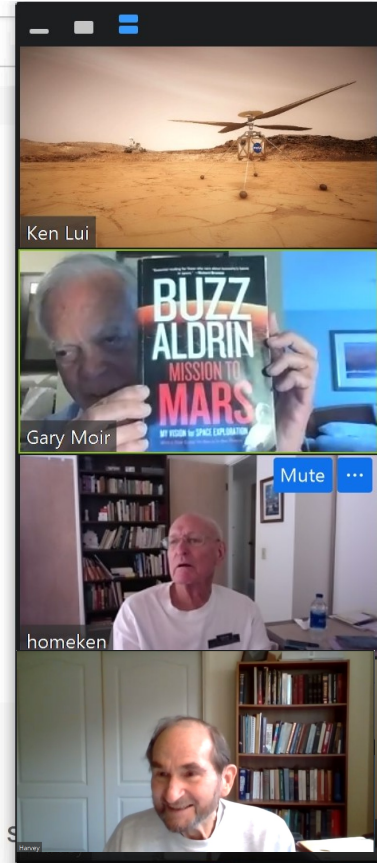
T [h=0]	-31	[°C]
P [h=0]	0.699	[kPa]
ρ [h=0]	0.01503	[kg/m ³]

LOS ANGELES

April 17 2021 AIAA LA LV New Space mini Conference 2021

80 views • Apr 20, 2021

5 0 SHARE



Mr. Gary Moir showing his copy of Buzz Aldrin's Book "Mission to Mars", while moderating the discussion with the retirees (aero alumni), while viewing the recording of the Raymer Manned Mars Plane (RMMP) presentation by Dr. Dan Raymer and 3 of the volunteers/speakers in the AIAA LA-LV New Space mini-Conference on April 17, with Dr. Ken Saunders and Mr. Harvey Eidinoff commenting/sharing enthusiastically.

[Overview](#)
[Technology](#)
[News](#)
[Multimedia](#)
[All Mars](#)

[INGENUITY](#)
[Home](#)
[Overview](#)
[Milestones](#)
[Five Things](#)
[Anatomy](#)
[Tech Specs](#)
[Media](#)
[Blog](#)

View, download and interact with the [Ingenuity 3D model](#).

Name [Ingenuity](#)

Main Job A technology demonstration to test the first powered flight on Mars. The helicopter rode to Mars attached to the belly of the [Perseverance rover](#).

Launch July 30, 2020, Cape Canaveral Air Force Station, Florida

Landed Feb. 18, 2021, Jezero Crater, Mars

Length of Mission Technology demonstration complete; transitioning to new [operations demo](#) phase

The aero alumni attendees (retirees) reviewing and discussing the details of the Ingenuity Mars Helicopter on the NASA Mars web page.

AIAA LA-LV Earth Day Celebration 2021 (2021 April 24)

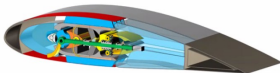
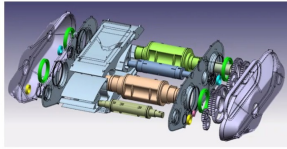
(1) "Taking off from your garden: It's possible!" by Mr. Jean-Philippe Régnauld and Mr. Michel Aguilar

(2) "Be Green, Keep flying" by Ms. Christine Lin and Mr. Chiu-Yüeh Blaise

(3) "The Climate of the 21st Century from Space" by Dr. João Teixeira

<https://www.aiaa-lalv.org/april-24-2021-aiaa-la-lv-earth-day-celebration-2021/>

A NEW PARADIGM AROUND THE HUMPREY CYCLE (4/6) The thermoreactor DNA & characteristics in a nutshell



DIFFERENCE in design

- An alternative device for opening/closing a combustion chamber is therefore exposed to extreme stress in terms of pressure/temperature and material resistance

The real technological disruptions

- In fact, the Thermoreactor and the continuous rotary movement of its valves is protected from the restrictions mentioned above,
 - The sealing is assured by linear and circular segments whose efficiency (leakage < 1%) has been demonstrated,
 - The current additive manufacturing allows complex realizations and important gains in terms of mass (enemy n°1 of aeronautics and space)
- Use of biofuels (methane, microalgae, hydrogen), without impact on food agriculture

Footprint

- The small size of the Thermoreactor allows it to be directly integrated into the wings or other parts of the aircraft,
- The design of the aerostructure is totally modified !



JP (Jean-Philippe) and Michel talking about the Humphrey Cycle and the thermoreactor DNS & characteristics for a new paradigm.

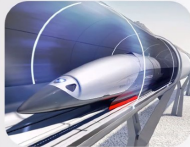
Flying in the future, a human challenge Future of transportation

E-VTOL



Source : Embraer

Hyperloop



Source : Hyperloop

Airship



Source : Flying Whales

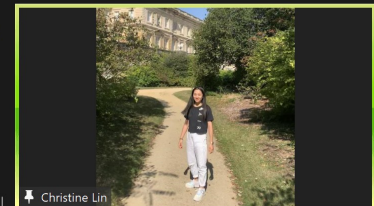
Supersonic



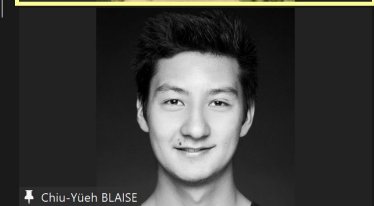
Source : Boom

- Electrical Vertical Take-Off and Landing (e-VTOL)
- Hyperloop
 - speed : up to 760 miles per hour in a low pressure tube
- Airship
 - Heavy transportation capacity

10% of the CO2 emissions of a commercial aircraft



Christine Lin

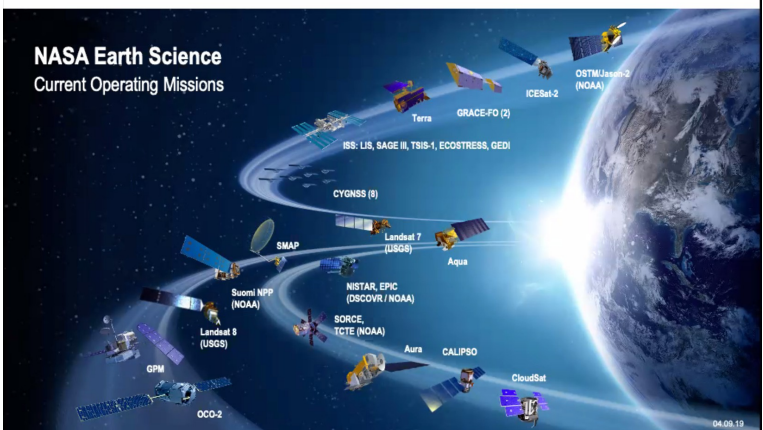


Chiu-Yüeh BLAISE

Christine and Chiu-Yüeh showing the future of flying as a human challenge, including e-VTOL, Hyperloop, Airship, and Supersonic.



A Fleet of Global Earth Observatories from Space



Dr. João Teixeira (left) mentioning the NASA Earth Science's fleet of Global Earth Observation from Space for studying Climate Changes.

(Continued on Page 46)

AIAA LA-LV Award Announcement and Ingenuity Talk (2021 May 1)

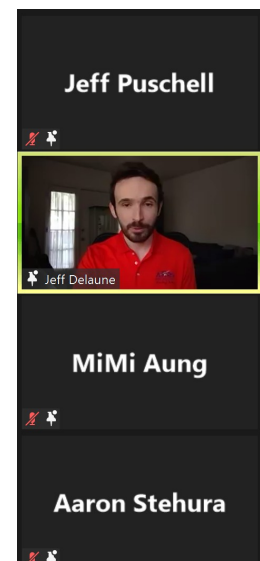
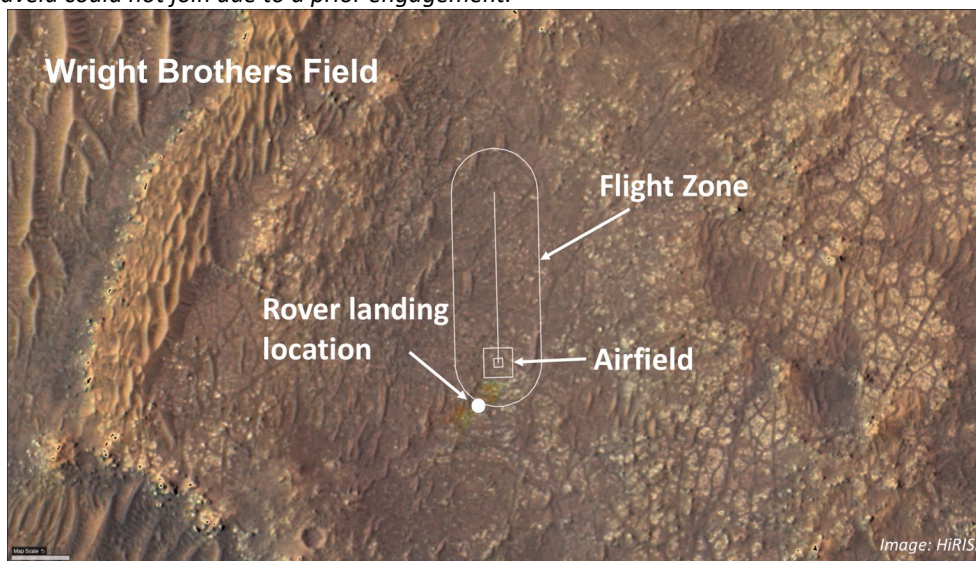
(1) AIAA LA-LV Excellence Award 2021 Announcement, by Dr. Jeff Puschell (AIAA Fellow);

(2) Ingenuity Mars Helicopter: challenges, first flights and live Q&A with a member of the team, by Dr. Jeff Delaune

Event Information: <https://conta.cc/3fYmMXP>



Dr. Jeff Puschell (upper left)(AIAA Fellow, Raytheon)(AIAA LA-LV Section Chair), announced the AIAA LA-LV Section Excellence Award 2021 in the opening session of the May 1st event on Zoom before the event presentation starts. Ms. MiMi Aung (lower left) represented the Ingenuity Mars Helicopter Team. Mr. Aaron Stehura (lower right) represented the Mars 2020 / Perseverance Rover Team. The event speaker, Dr. Jeff Delaune (upper right), gave a presentation on the Ingenuity Mars Helicopter after the Award Announcement. Prof Madhu Thangavelu could not join due to a prior engagement.



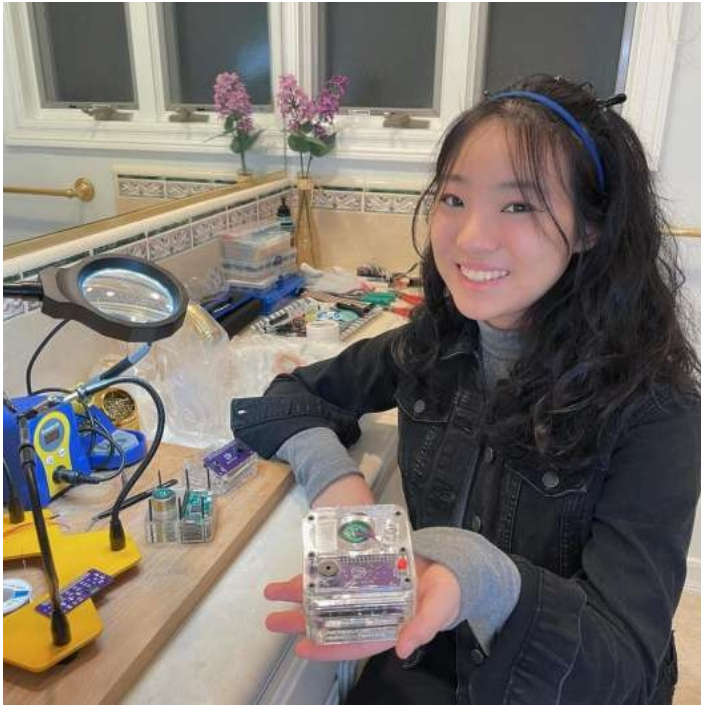
Dr. Jeff Delaune, the event speaker, showing the "Wright Brothers Field" at the Mars 2020 Perseverance landing site. Previously Dan Dumbacher, AIAA Executive Director, praised the Ingenuity's first flight: "we'll remember 19 April 2021, at Jezero Crater, Wright Brothers Field, Mars, just as we have remembered 17 December 1903, at Kitty Hawk, North Carolina, Earth." *(Continued on Page 48)*

High school junior's consumer seismometer delivers low-cost earthquake early warning

(Editor's note: Vivien gave a demo in the AIAA LA-LV Webinar on Feb. 20)

by Seismological Society of America, April 23, 2021 (with permission) ([*Vivien is an AIAA High School Student Member](#))

<https://phys.org/news/2021-04-high-school-junior-consumer-seismometer.html>



Vivien He with her earthquake early warning device in her makeshift soldering room converted from a bathroom. (Credit: Vivien He)

A Southern California high school junior has built a low-cost seismometer device that delivers earthquake early warnings for homes and businesses. Costing less than \$100 for her to make today, the seismometer could someday be a regular household safety device akin to a smart smoke detector, says its inventor Vivien He.

About the size of a Rubik's cube and encased in clear acrylic, the seismometer has a sleek, consumer-ready look. The device's geophone detects incoming ground motion, while onboard hardware and software translate the geophone's electrical signals into a digital waveform. The device has detected all earthquakes over magnitude 3.0 around Los Angeles since September 2020.

When earthquakes are stronger than the alert threshold set by the user, the device can sound the onboard alarm for on-site warning, send a text message to local subscribers of the regional warning service, and can be controlled from a smartphone.

He presented her research on the device at the Seismological Society of America (SSA)'s 2021 Annual Meeting. She also won a SSA Student Travel Grant, the

only high school student among all recipients, to attend the conference free of charge. She is a student at Palos Verdes Peninsula High School in Rolling Hills Estates. He thanks her science research class teacher, Melissa Klose, for her guidance on scientific research methods and her support in pursuing research opportunities.

He researched, designed, built, and tested the entire device over a summer and fall spent at home under COVID-19 restrictions. Her home lab occupies a corner of a bedroom with "bedside drawers full of little wires and extra geophones and components," she said.

There was also the bathroom she borrowed where the bright light was good for soldering. For acrylic laser cutting, her dad helped her drag a table out of the garage into the yard as a safety precaution.

"I did—don't tell my mom—but I did one time have a little bit of a fire," she admitted.

The seismometer device fills a gap in current [earthquake](#) early warning systems, He said, by providing a consumer-friendly, low-cost but built-for-purpose alternative to more expensive, scientific-grade systems like the West Coast's ShakeAlert system. Her device offers a way for people in earthquake zones to gain a few to tens of seconds of warning to take action and automatically shut down utilities and machinery at work.

He has set up a nonprofit, Melior Earth, to help her get the device to those who need an inexpensive earthquake early warning system. "I do have hopes that I would be able to provide this to lower-income families and neighborhoods with less earthquake-proof infrastructure," she said.

Quiet Under Quarantine

He got the idea for the seismometer after reading a paper about the unusual seismic "quiet" that descended over the earth when COVID-19 lockdowns brought a halt to much human activity. "I was wondering whether I would be able to measure that from my own home," she recalled, "and then that quickly evolved into, I wonder if I can measure in my own home and apply it to earthquake early warning?"

([Continued on Page 49](#))

Cancel the drag

by Michel Aguilar, Science Journalist at the Dépêche du Midi, French Air Force – Retired

(Beginning of Part I)

Sometimes Science takes more than surprising ways! Let's judge with this announcement about the Titanic going to the United States:

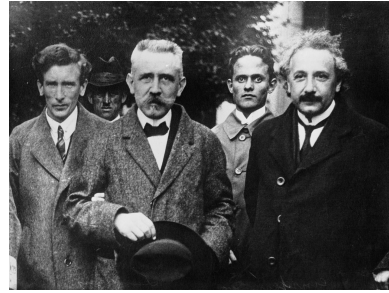


Fig. 1: Paul Langevin and Albert Einstein (Credit Wikipedia & M. A.)

This is how the invention of the underwater radar, the sonar, was born, in collaboration with the famous French physicist, Paul Langevin (above with the very famous Albert Einstein!) to detect icebergs:

But who is Constantin Chilowsky? He was a Russian scientist who immigrated to France in the early 20th century. His creative genius was used in many fields, especially in aerodynamics.

Patented Oct. 23, 1923.

1,471,547

UNITED STATES PATENT OFFICE.

CONSTANTIN CHILOWSKY AND PAUL LANGEVIN, OF PARIS, FRANCE.
PRODUCTION OF SUBMARINE SIGNALS AND THE LOCATION OF SUBMARINE OBJECTS.
Application filed May 19, 1917. Serial No. 169,804.

Indeed, Constantin Chilowsky, seeking to reduce the resistance that the air opposes to any vehicle moving in it (called the drag, and characterized by the coefficient CD), as for example the shells used by the French army then in war against the German army in this beginning of 20th century. So, by reducing this drag, the French shells had to have a much higher range than the German shells. Tests were carried out by Mr Chilowsky as shown in this historical movie of 1917: <https://images.cnrs.fr/video/4277>

Movie in which we observe that the security of the operators was then in its very beginning...

Constantin Chilowsky registered patents in France which he extended to the United States:

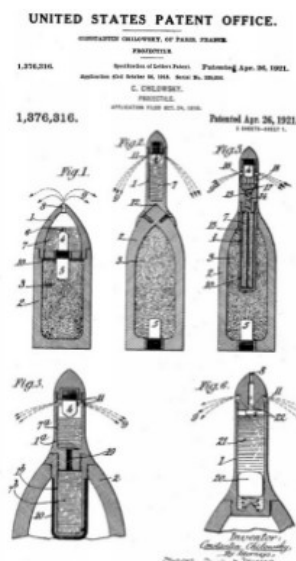


Fig. 2: Chilowsky patents (Credit: Google patent & M. A.)

(Continued on Page 50)

A Cloud Black Box That Gentlemen Do Not

by Jerry J. Huang, an aviation enthusiast and a retired researcher in air safety for CAA in Taiwan

Let us start with the following questions.

What is the difference between safety, security, surveillance and spying?

The answer is: They are all the same in terms of the technologies. It also depends on your point of view. Spying is done without your knowledge. Surveillance is a form of legal action to monitor. Safety and Security can be the outcome of surveillance and spying.

What was the most famous and bizarre notion/quotation in the field/history of espionage?

“Gentlemen do not read each other’s mail”-

Yet another Stimson Doctrine, by U. S. Secretary of State Henry Stimson 1929

Why a modern airliner disappeared into thin air?

Why “Gentlemen Do Not” is for the title for this article?

There is a question we don’t have an answer to it yet. It is in the article for the context is needed to present the question. Please feedback if you have an answer , thanks!

Introduction

An article was in AIAA LALV Newsletter March, 2020 describing the Automatic Dependent Surveillance–Broadcast (ADS–B). It is a surveillance technology in which an aircraft determines its position via satellite or through other sensors and constantly broadcasts it, enabling the aircraft to be tracked. The ADS-B is an element of the United States Next Generation Air Transportation System (NextGen). FAA began to enforce the rules since 2020. The technology is also adopted and utilized by other civil aviation authorities, and crowd-sourcing private companies such as FlightRadar24.com and FlightAware.com to track aircraft all around the world. An extraordinary example was the shot down of the Ukrainian Airlines Flight 752 over Iran in 2020. It was first reported and recorded by the users of FlightRadar24 ADS-B kit in Tehran.

Latest utilities also made it feasible for an online flight data/voice recorder or Black Box, possibly to prevent future mishaps from happening in the first place more

than investigations after a crash. Some pilot errors might have been corrected in time to prevent an accident. The concept behind the smart phone TrackView apps we are about to explain here is also resembles the Automatic Dependent Surveillance (more toward the Spying side though) ADS, but not B for broadcast. This utility communicates by means of the Internet. So, we may say that it is an ADS-Cloud. It has the potential of preventing what happened to the Malaysian Airlines MH370 mystery, save lives or intrude privacy. It was tested in the air, over the ocean and on land. Readers can download the apps from TrackView.net free of charge with no subscription. A WiFi or wireless phone carrier’s data plan is needed for the Internet access.

Historical Backgrounds

In the 1960’s, U. S. Air Force had a clandestine manned space program to replace CIA’s U-2 for the spy planes that had been shot down multiple times over Russia, Cuba and China. The space program is not officially declassified (PBS NOVA AstroSpies).

In the 1980’s, President Reagan released the then secret military Global Positioning System (GPS) for civilian use after Korean Airlines Flight 007 was shot down over Soviet Union, so that similar tragedies of navigation errors would never happen again. Other countries learned from the advanced navigation/communication technologies, followed Reagan’s open navigation policy. For examples, Russian’s Glonass, European Union EU’s Galileo and China’s BeiDou (The Northern Dippers) were all made available to civilian use for the cause.



President Reagan and Abrahamson (Credit/Source: Wikipedia)

(Continued on Page 58)

The case for restoring US nukes in East Asia

US removed tactical nuclear weapons from Korea, Japan and Taiwan long ago but China's rise has changed deterrence calculations

by Dr. Stephen Bryen, Former Deputy Under Secretary of Defense, 2021 May 6 (with Permission)

<https://asiatimes.com/2021/05/the-case-for-restoring-us-nukes-in-east-asia/>



American missiles on pointy display at the war museum in Seoul, South Korea. Photo: AFP/Philippe Lopez

From the late 1940s until the 1970s the United States deployed a considerable arsenal of nuclear weapons outside of the continental United States, or CONUS, in Pentagon jargon.

American nuclear weapons were hosted in 27 different countries. In NATO Europe 7,000 US nuclear weapons were positioned in several countries and they remain in the UK, Belgium, Germany, Greece, Italy, the Netherlands and Turkey.

Today, the US has hardly any tactical nuclear capability in North and East Asia and its regional bases in South Korea, Japan, Okinawa and Guam are vulnerable to Chinese missiles and nuclear-capable long-range bombers.

So will the US return tactical nuclear weapons to the Pacific as tensions rise with China? Much has changed in the global power balance as the US posture on nuclear weapons evolved.

Germany, which was considered during the Cold War as the prime target of the USSR and its Warsaw Pact allies, had 21 different types of US nuclear weapons there to deter Moscow.

In Asia, the US had roughly 2,000 land-based nuclear weapons in South Korea, Japan, Okinawa and Taiwan where some 200 nuclear weapons were positioned. In addition, the US Navy had another 3,000 nuclear

weapons of different types on aircraft carriers, cruisers, destroyers, frigates and attack submarines.

Guam was loaded up with 20 different nuclear weapons types while Okinawa had 19. All of these weapons were designed to deter China and North Korea. And most of these weapons are now gone.

Before China had a significant nuclear capability, the US at least twice threatened to use atomic weapons against North Korea and China, the first in the Korean War and the other when China threatened to take over Quemoy (Jinmen) and Matsu (Mazu) islands as a prelude to invading Taiwan.

In the first case, president Harry Truman rejected advice he was getting from his Air Force commanders and did not approve strikes against North Korea.



A missile test fire from a US nuclear submarine. Image: AFP

In the second, president Dwight Eisenhower authorized preparations to use atomic weapons against China. The initial US Air Force plan was to drop between [10 and 15 atomic weapons](#) on “selected fields in the vicinity of Amoy (Xiamen).”

The Air Force plan of attack would have used bombers stationed either at [Kadena Air Base](#) in Okinawa or [Anderson Air Base](#) on Guam. The likely nuclear bomb would have been the [MK-6](#) and the likely delivery system a strategic bomber.

(Continued on Page 63)

Morf3D to reinvent the future with launch of 90,000 sq. ft. Applied Digital Manufacturing Center

by Morf3D Inc., 2021 April 19 (with Permission from Mr. Ivan Madera, CEO of Morf3D Inc.)

<https://www.prnewswire.com/news-releases/morf3d-to-reinvent-the-future-with-launch-of-90-000-sq-ft-applied-digital-manufacturing-center-301270930.html>



Morf3D Long Beach, CA

EL SEGUNDO, Calif., April 19, 2021 /PRNewswire/ -- Morf3D Inc. a trusted leader in metal additive manufacturing (AM) specializing in AM optimization and engineering for the Aerospace, Defense, and Space industries, announced today that it has secured a new headquarters in Long Beach, California. Located at 3550 Carson Street, Long Beach, CA. The 90,000 sq. ft. space will house both the company's business operations and an unprecedented advanced manufacturing facility. This new headquarters has been designed with a vision toward innovation and growth, marking the strategic launch of Morf3D's Applied Digital Manufacturing Center.

Morf3D's premiere Applied Digital Manufacturing Center will harness applied research, advanced engineering and application development, serial production and most significantly, new industry partnerships with global leaders to drive the industrialization of digital manufacturing in high growth markets. With these partnerships, Morf3D will support new developments and exciting innovations to accelerate customer adoption and overall industrialization of digital manufacturing.

Ivan Madera, Chief Executive Officer at Morf3D said, "It's been a long-term vision of ours to position Morf3D as innovation partner versus a part manufacturer. The recent strategic investment by Nikon Corporation affords our customers access to cutting-edge technology that will

create an entirely new value chain that reinvents aerospace manufacturing. The Applied Digital Manufacturing Center will go beyond adding capacity or capability, we're focused on solving the problems related to manufacturing and qualification of AM flight hardware across multiple disciplines. This will be a gamechanger."

Morf3D's investment in this new California facility underscores their commitment to developing a strong industrial base that improves the quality of their products, enhances Morf3D's technical capabilities, and enriches customer applications worldwide. At peak, the center will be home to 150 multi-discipline engineers, research staff, and technical teams.

About Morf3D

Morf3D Inc. specializes in metal additive engineering and manufacturing, providing advisory services in additive manufacturing strategy and technology adoption road-mapping. Morf3D's mission is to enable client proficiency in fully exploiting the benefits of additive engineering and manufacturing, while delivering innovative solutions that solve complex design and manufacturing challenges.

For more information about Morf3D, visit <https://morf3d.com>

Student-Led Moon Dust Shield Team Named Finalist in NASA Competition

by Andrew Moseman, Caltech (California Institute of Technology) (with Permission)

<https://www.caltech.edu/about/news/nasa-big-idea-homes-habitat-orientable-modular-electrodynamic-shield>

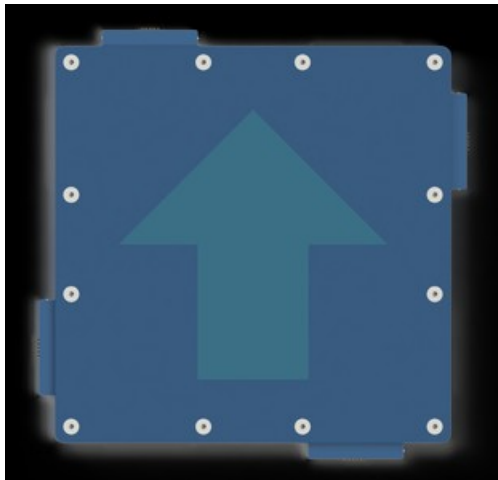
Moon dust, the fine, fluffy powder covering the moon, is the stuff of imagination, the subject of scientific inquiry, and potential building block for lunar colonies.

It is also a menace to exploration.

As astronauts walk across the moon, land spacecraft on its surface, drive lunar rovers around, or complete other astronaut tasks, they kick up the dust, and that is a problem because it can cause premature wear on mechanical parts, damage to seals, and may pose a health risk for the people breathing it in. Additionally, it has qualities that make it cling to nearly every available surface.

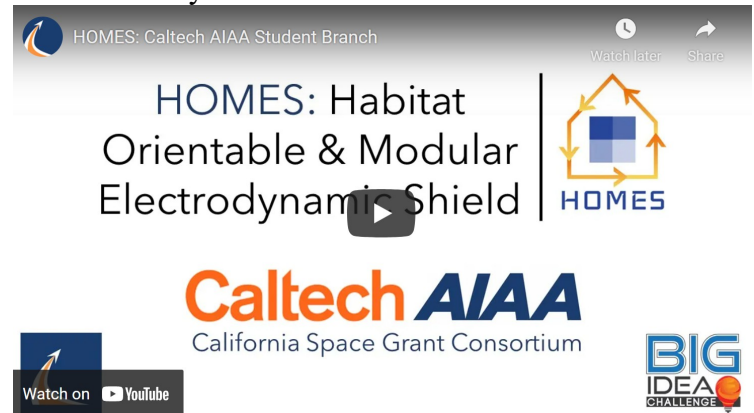
"The sun is shining directly on these particles and giving them an electric charge," says third-year Caltech undergraduate student Luis Pabon. "This causes it to stick to the astronaut's suit or to any sensors or cameras that you put out on the moon."

NASA has known about this issue since the Apollo 11 astronauts dealt with dust during their landing in 1969. Last year, the agency's Breakthrough, Innovative, and Game-changing (BIG) Idea Challenge asked university teams to invent solutions to the pesky dust problem. Now NASA has named a group of Caltech undergraduates as one of seven **BIG Idea Challenge finalists** for their idea to combat dust on boots from entering into the astronauts' habitat or craft.



Render of the HOMES tile. (Credit: Caltech HOMES team)

The Caltech team's invention, named Habitat Orientable & Modular Electrodynamic Shield (HOMES), tackles the problem of moon dust entering a potential lunar habitat and wreaking havoc within. HOMES is a modular system of square tiles about the thickness of an iPhone that can be arranged into a flat surface. The tiles make up an electrodynamic dust shielding (EDS) system. Wires embedded within the tiles create an electrical field that extends like a forcefield across the tiles' surface, explains third-year student and team member Isabella Dulá. The dust particles carry an electrical charge given to them by rays from the sun, so the electrical field on the tiles repels them. Thus, by varying or alternating the current in the wires, or by changing the orientation of the tiles, a user can tailor the electric field to move dust in a controlled way.



"HOMES could be on the floor of a changing room in an airlock, and any dust that falls to the floor can then be transported to a singular zone because we can orient the panels to move the dust in a specified direction," says second-year Caltech undergraduate Malcolm Tisdale, one of the leaders of the team, which is mentored by Bren Professor of Aerospace Soon-Jo Chung. "That would allow astronauts to much more easily clean a pile of dust instead of it being spread over the entire room."

The students' involvement was set in motion last fall when Tisdale and Pabon approached Chung to restart a campus chapter of the American Institute of Aeronautics and Astronautics (AIAA), a professional organization for the field of aerospace engineering. Pabon, a HOMES

(Continued on Page 65)

Countering Objections to Space Settlement¹

by Al Globus, May 2021 (with Permission)(based on the Author's prior article on Ad Astra)

Space settlement is moving from the fringe of space conversations towards the center. As this happens some will object to one or more aspects of space settlement. Most of these objections have been heard before. Indeed, since space settlement became part of the discussion with Gerard O'Neill's work on free space settlements in the 1970s, many of the same objections have surfaced again and again. The space settlement movement, including this author, has some experience responding to these attacks. This paper is intended to be a place to find rebuttals to objections to space settlement. For each objection there are talking points and a brief discussion.

The objections are broken into categories: General objections, It cannot be done, Power plays, and Miscellaneous.

First, we must know what a space settlement is and why one might want to settle space.

What is a space settlement?

For the purpose of this paper, a space settlement is a place to live beyond Earth's atmosphere, including raising families. This involves living on a planet or moon or in orbit, including co-orbiting with an asteroid. In-orbit settlements are often called free space settlements.

Why settle space?

Talking point: To survive and thrive.

Survive

Someday the Earth will become uninhabitable. Before then life must move off the planet or become extinct. While inevitable, this could be billions of years in the future. Much more near term threats include climate change, major asteroid hits, supervolcano eruptions, nuclear war, pandemic, nearby supernova, and technology run amok (for example, the Grey Goo² and Paper Clip Apocalypse³ problems) many of which could happen at any time.

¹This paper is derived from Facing Arguments Against Space Settlements published in Ad Astra in the Winter of 2020 by the same author and which shares a good deal of text.

²The Grey Goo problem is from the nanotechnology tradition. In it, a 'universal catalyst' embedded in reproducing molecular machines turns everything it can reach into grey goo.

³The Paper Clip Apocalypse problem is from the Artificial Intelligence (AI) tradition. It involves the construction of a very capable intelligent machine that is instructed to produce optimal paper clips. The machine then turns everything within reach into paperclips.

⁴Space solar power refers to collecting energy in space and beaming it to Earth. Space solar power can, at least in principle, supply Earth with enormous amounts of very clean electrical energy.

Space capabilities can reduce some of these threats. For example, spy satellites have played an important role in avoiding nuclear war thus far. Space settlement can prevent asteroid hits as an extensive space civilization would likely monitor all asteroids and comets as a potential source of materials for free space settlements and divert any objects heading towards Earth. Special purpose space settlements for developing potentially dangerous technologies can improve safety when used as laboratories isolated from the rest of humanity by hundreds of kilometers of vacuum and radiation.

In addition, in the event of a planet wide disaster not only might billions of people die, but recovery would be difficult since the whole planet is affected. If an extensive branch of our civilization is in space before any of these threats manifest, the unaffected space settlements can provide aid up to and including reseeded Earth.

Thrive

Why build space settlements? Why do weeds grow through cracks in sidewalks? Why did life crawl out of the oceans and colonize land? Because living things want to grow and expand, to thrive, not simply exist. Alone of all species we have the ability to go to space by developing rockets, pressure vessels, space farms, and the hundreds of technologies necessary for living things to survive in space. Note that if we don't take the next expansion step there is no one else that can.

A key aspect of space settlement thriving is the ability to **build new land**, rather than take it from someone else. This allows, but does not guarantee, a thriving, expansive civilization without most resource wars or destruction of Earth's biosphere. In the space settlement era resource wars are unlikely and unnecessary because our Sun provides billions of times the energy used on Earth and the asteroids provide enough material to make new orbital land hundreds of times greater than the surface area of the Earth. Destruction of Earth's biosphere can be avoided by moving most environmentally damaging activities off of Earth.

For example, a space solar power⁴ system's space segment could be built from lunar or asteroidal materials without touching Earth's biosphere.

General objections

This section contains general objections such as space settlement being too expensive.

Objection: Space settlement uses money that could be better spent on housing, food, medical care, etc.

Talking point 1: Most resources should and do go to today's human needs, but a small fraction should be our seed corn, to be spent on the future.

(Continued on Page 66)

Remembering Michael Collins

(Continued from Page 2)

once Neil was near the bottom, he released a lanyard that allowed a miniature television camera to be activated, and we could finally see things in near real time from another world. The video was grainy and blotchy, not to mention black and white rather than “Living Color.” It was also only being broadcast back to us at 10 frames per second, which gave everything a ghostly appearance.

On Earth, more than 650 million people watched the events unfolding live. This was the largest single television audience in history up to that time. The one person who couldn’t see those historic bootprints on the Moon was Michael Collins. Mission Control radioed to Mike, saying, “I guess you’re about the only person around that doesn’t have TV coverage of the scene.” Mike responded by saying, “That’s all right. I don’t mind a bit.” His view of the lunar surface out the tiny windows on the Apollo 11 Command Module “Columbia” was more spectacular than anything that could be watched on a fuzzy television screen.

Mike also had the only ride home for all three of the astronauts. Although he says he never openly discussed the possibility with Neil and Buzz, the fact that the Lunar Module “Eagle” might not be able to get off the surface to rendezvous and dock with “Columbia” was very much on his mind. Collins reflected, “It was a solitary, single, one chamber. That chamber either ignited properly and got you the thrust, or it didn’t. If it didn’t, Neil and Buzz were dead on the surface. So, that was a very critical worry point for me.”

He joked about what he might have said to them, if that happened. “Hey, Neil, suppose you are stranded forever on the surface of the moon. Would you mind terribly if I just sort of headed home?” More soberly, he said, “I

mean, it wasn’t the kind of thing one talked about, but it was a presence. It was there.”

What was the meaning of it all for Mike? It was seeing the Earth in the vast void of space. He was one of the first to truly understand our tiny place in the universe, saying, “I would look out the window, and there would be a tiny little thing. You know, you could obscure it with your thumb. But every time you put it away somewhere, it would pop out. It wanted you to look at it. It wanted to be seen. It was gorgeous. It was tiny, shiny, the blue of the oceans, the white of the clouds, little streak of rust color that we call continents. It just glowed. Having gone out 240,000 miles and seeing it gives me a much greater sense of fragility, a much greater urge to do something to protect that fragility as we go along.”

It was that image of Earth brought back by the Apollo astronauts that launched the environmental movement, and someday, because of that, we might eventually make ourselves better stewards of our planet. Mike was proud of being part of that.

All of those people who have been to the Moon, whether orbiting solo in the Command Module, or landing in the Lunar Module and walking on the surface of another celestial body, were born between 1923 and 1936. The majority of those, including Michael Collins, were born in 1930. Speaking about arriving on Earth at the time that allowed him to participate in the greatest exploration achieved by humankind, Mike had this to say: “We just wandered by at exactly the right moment. And that is a consummate example of luck, luck, and more luck. I am a big believer in luck.”

We were all lucky to have had Mike Collins come along right when he did.

Space Shuttle Columbia, A Personal Journey

(Continued from Page 3)



Michelle with Columbia in the background on the Edwards lakebed after landing on STS-1.

For myself, I had recently separated from the US Air Force after working on missile systems for more than seven years. I was raised on the space program, never missing a launch or major mission event, no matter what time it occurred. I stayed up all night when watching Neil Armstrong land and walk on the Moon during the mission of Apollo 11. Twelve years later I did it again to see Columbia launch, which occurred at 4:00 am here in California. With the mission scheduled for little more than two days, there was no time for sleep.

Even though I worked in aerospace engineering, my first loves were writing and photography, and STS-1 marked the first time I was covering a spaceflight as accredited news media. I drove up to Edwards on Monday evening, and got my place out on the south side of the lakebed to cover the Tuesday morning landing. I was in the third spot to the east of the ABC News platform that day.

The media site was a massive hive of activity with press from around the world. At the ABC site their Chief Science Editor, Jules Bergman, talked about the historic flight of Columbia with Apollo 17 Commander Gene Cernan, while we awaited the Shuttle's arrival. Science Reporter Lynn Sherr noted that it wasn't just scientists and engineers excited about the flight as she interviewed Directors Steven Spielberg and George Lucas.

Out of the thousands of reporters at the media site, I have the distinction of being the first to have spotted

Columbia as she entered the Heading Alignment Circle high over our heads. Just moments later, the distinctive double sonic boom of the Space Shuttle was heard for the first time.

Columbia sailed majestically in front of us, dropped her landing gear, and finally touched the hard packed surface of the Rogers Dry lakebed on Edwards Runway 23 at 10:21 am on 14 April. Young and Crippen put the shuttle orbiter down on California's Mojave desert with such precision that she rolled to a stop directly in the middle of her runway, but also at the exact center of the confluence of several lakebed runways.

After fighting the traffic and the dust kicked up by vehicles from everyone at the media site trying to race back across the lakebed to the main base, I searched out a decent spot from which to get images of Columbia sitting on the runway — and had to grab a self portrait along the way. The Crew Van headed out to pick up Young and Crippen, to bring the crew back to the media site at the Dryden Flight Research Center where a "Welcome Back Columbia" sign greeted them.

STS-1 spaceflight rookie Bob Crippen enthusiastically talked to the crowd, while his commander, now five-time space veteran John Young, hung back and watched. Young then came forward himself, saying, "We're not too far, the human race isn't, from going to the stars." It's been a long time coming, but I hope he is right.

With all this behind her, Columbia then did a truly remarkable thing for a spacecraft. She was mounted to the back of the 747 Shuttle Carrier Aircraft and flown back to the Kennedy Space Center. She was then fully refurbished, and made ready for a second flight into space exactly seven months later, on 12 November 1981.

I was back in my same spot on the south side of the lakebed at Edwards at 1:23 pm two days later to grab my next set of landing photos. This time was extra special in that the commander of STS-2 was Joe Engle, who had previously flown sixteen missions on the X-15 rocket plane in the 1960s from this same location at Edwards. Three of those X-15 research missions qualified Joe for astronaut status, making him the first and only person to become an astronaut before actually entering orbit. They

(Continued on the next page)

Space Shuttle Columbia, A Personal Journey

(Continued from the previous page)

also qualified Engle to be the only Shuttle Commander to be allowed to fly the Orbiter manually, all the way from the de-orbit burn to landing on the lakebed at Edwards.

I had only recently started a new job, so I couldn't take leave to travel from California to New Mexico for the third landing when Columbia and the crew of STS-3 were diverted to White Sands, New Mexico because of weather. However, I was back at Edwards for STS-4 on 4 July 1982. My typical setup of cameras to cover a landing usually consisted of at least three tripods, one of which had an 8-inch reflecting telescope mounted to it, along with two others smaller lenses on less hefty tripods.

It was a heck of a way to celebrate Independence Day to watch Columbia return to Earth for the fourth time. There were approximately one million public spectators that day out at the public viewing site, along with a few thousand more of us in the news media at the Flight Research Center itself.

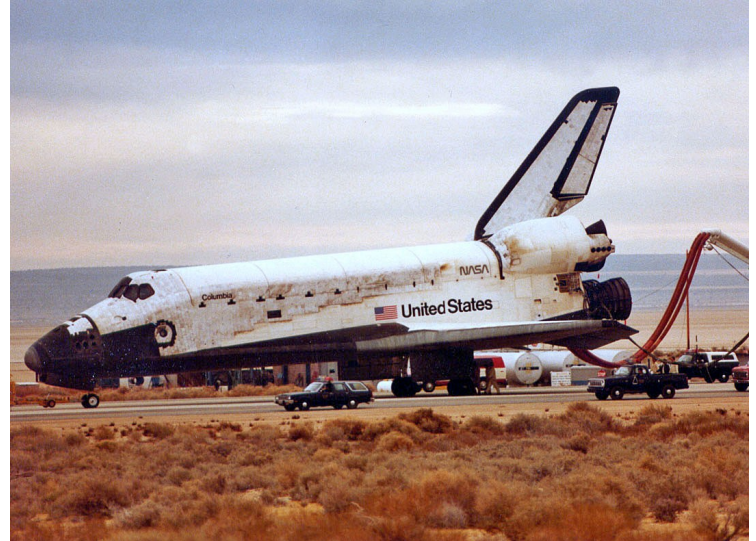
One of the reasons for the huge crowd was that President Reagan was there to watch Columbia's landing. As he stood in front of the Space Shuttle Enterprise — with a bizarre blue carpet covering the wing — soon after Columbia arrived, the President gave the order for the 747, with the Shuttle Challenger on its back, to take off on its trip to Florida to be prepared for its first launch on STS-6 in April 1983.

Columbia returned yet again to Edwards at the end of STS-5 in November 1982. The Rogers lakebed, gives a vehicle lots of room to maneuver on landing, so this was the perfect location for the early test flights of the Shuttle program.

Once the Orbiter was safed, they towed Columbia across the lakebed to the Mate/Demate Facility where she was processed for the ferry flight back to the Kennedy Space Center. This afforded many opportunities for a closer photographic inspection.

On his sixth and final spaceflight, John Young brought Columbia back to Edwards again at the completion of STS-9. It was late in the afternoon of 8 December 1983, when the Shuttle landed so that she was still being processed on the lakebed after dark. It was amazing to

watch all the activity still happening inside the Orbiter, with the glow of the cockpit lights, and people scurrying about the lakebed.



Columbia is towed toward the Mat/Demate Facility after completing mission STS-5 on 16 November 1982.

One of my favorite later missions was the landing of STS-58 ten years later, in November 1993. A good friend of mine, astronaut pilot Rick Searfoss, was sitting in the right seat as Columbia touched down at 7:05 am that morning. It also was probably the closest I was able to get to the touchdown point of the Orbiter. We used to be much further back from the runway, but the B-2 Spirit stealth bomber had recently gone into test at a new facility on the South Base at Edwards. They had to move us forward to be far enough away from the highly classified B-2, and they even threatened us to not turn around and take photos of the bomber's new facilities.



Columbia is a moment from touchdown at the end of STS-58 on 1 November 1993, with pilot/astronaut Rick Searfoss in the right seat.

(Continued on the next page)

Space Shuttle Columbia, A Personal Journey

(Continued from the previous page)



Columbia is towed by the Edwards control tower several hours after landing.

I tried to cover the Shuttle well during my trips to Edwards, but the images were always looking at one side of the Orbiter or the other as it flew by, or was towed for processing. By this time I was looking for something different. I knew they brought the vehicle past the Edwards Control Tower so I set out to get permission to be on top of the tower this time when it happened. I met with some resistance, saying they couldn't figure out why I might want to do that. But I was determined. After a lot of cajoling, I got permission to be up there. As Columbia neared, it was almost lost with all the F-16s, T-38s, and other miscellaneous aircraft parked near the hangars. As she got closer, I was able to capture the sequence I wanted as she rolled by directly below the tower. Others who came with me up to the tower's catwalk, who had previously been skeptical of my request, soon understood why I was there, and got excited themselves to see Columbia from this new perspective.

STS-93 marked the first mission to ever have a woman as the commander. Eileen Collins took Columbia onto orbit for the 26th time to deliver the Chandra X-Ray Observatory to space. Just two months later, on 24 September 1999, Columbia arrived back in California at the start of a two year long major modification period, which included installing the new MEDS, or Multifunction Electronic Display Subsystem, more commonly known as the "glass cockpit."



Columbia returns to Palmdale for a major overhaul on 24 September 1999, and is removed from the back of the 747 Shuttle Carrier Aircraft which ferried the Orbiter to California from Kennedy Space Center in Florida.

I took a series of photos that day as Columbia was removed from the back of the Shuttle Carrier Aircraft, lowered to the ground, and moved inside the Boeing hangar in Palmdale, where it would be brought up to 21st Century standards. It should also be noted here how the lineage of the shuttle changed over the years. When contracts were first signed, the company that built the Orbiter was North American Rockwell. Several years later it became Rockwell International, which was then assimilated by Boeing in 1996. The Shuttle remained under Boeing for the rest of the program through retirement in 2011.

Just six months after watching Columbia arrive back at Palmdale, on 27 March 2000, I returned for an extraordinary day with OV-102. With me that day was my good friend Jeff Howe. Our mission was to document Columbia as the refurbishment took place.

They took her down nearly to the underlying structure of the Orbiter, working on the thermal tiles, taking apart sections of the wing, fuselage, and tail. On top of the tail was a special pod, unlike anything installed on other Orbiters. This was the SILTS pod, which stood for the Shuttle Infrared Leeside Temperature Sensing system. It measured the heat experienced by the Columbia during re-entry. At the time of this modification, the actual sensor had been removed, but the pod was hopefully to be used for future experiments, but that never occurred.

(Continued on the next page)

Space Shuttle Columbia, A Personal Journey

(Continued from the previous page)



Michelle crawling through the access tunnel into the Mid Deck of Columbia on 27 March 2000.

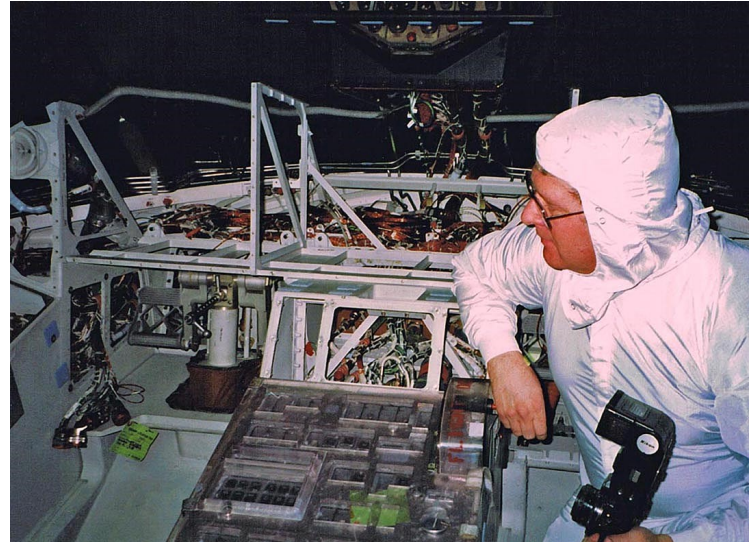
I was able to see Columbia from all perspectives, even looking down from the top of the tail to the wing, more than 50 feet below. But beyond documenting the outside of the Orbiter, this was a very special day in that Jeff and I were to climb aboard Columbia and check her out from the inside as well. Before entry, we had to don head-to-toe white bunny suits, then we crawled through a tunnel leading through the crew hatch.

Our guide that day was Al Hoffman of Boeing. He helped with the still and video cameras I carried, and made sure to help document the experience as Jeff and I crawled through Columbia.

Immediately after entering onto the Mid-Deck, the entrance to the airlock was on our right. This led out to the cargo bay, but the hatch had been removed for refurbishment, and was sealed with plastic, so we would have to enter the bay later through a different hatch in the exterior cargo bay wall. But first it was time to climb up the ladder from the Mid-Deck onto Columbia's Flight Deck.

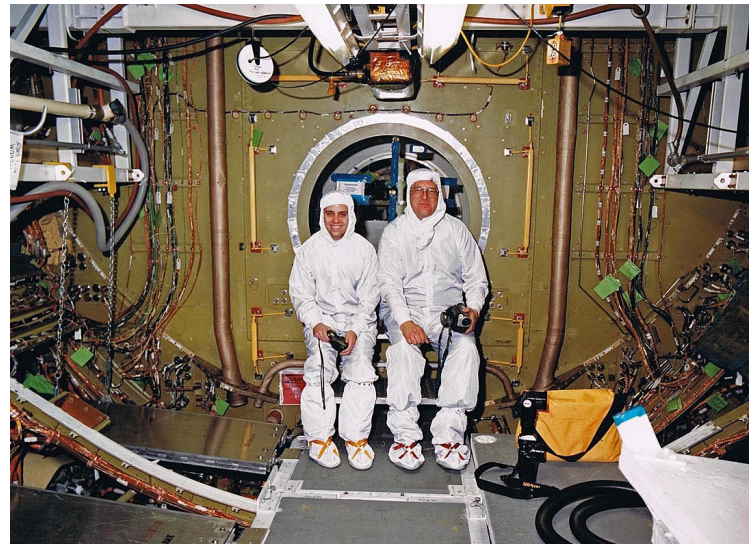
Most of the cockpit equipment had been removed at this point so the new glass cockpit could be installed. The consoles were all opened up, frames empty of equipment and gauges, the computers gone, and the seats had been removed. I sat in the well that would normally be occupied by the pilot's seat, and leaned across the center console into the commander's position. The cockpit

windows were to my right, and were blocked off with protective panels over the multiplane-reinforced glass.



Michelle in the cockpit of Columbia during refurbishment, in the position where the pilot's seat would be.

When we completed our tour of the crew cabin, we had to exit back through the tunnel in order to enter the cargo bay through an outside fuselage hatch. It was a tiny hatch that I never even knew existed before that day. I had to pass my equipment through to Al, then Jeff and I crawled through the opening to enter the expansive cargo bay.



Jeff and Michelle sitting in Columbia's cargo bay airlock hatch.

(Continued on the next page)

Space Shuttle Columbia, A Personal Journey

(Continued from the previous page)

Inside the bay, all the floor coverings were removed, and catwalks put into place over the exposed underlying structure of the bay, with wiring and conduits exposed so we could safely walk about. Jeff and I sat in the cargo bay hatchway for an official portrait inside Columbia. Behind us was the hole where the crew module hatch had been removed, and where we had just visited. This concluded our tour of Columbia, and we again had to squeeze through the fuselage hatch to exit.

We returned eleven months later, on 23 February 2001 for one last glimpse, after all the modifications and upgrades were completed. While we were in the hangar, Columbia was being prepared for her cross-country flight back to the Kennedy Space Center in anticipation of future missions to space. Jeff and I took a last group shot with Columbia before she headed east. The Orbiter would fly successfully just once more in March 2002 on STS-109, which was the 4th Hubble Space Telescope servicing mission.

On 16 January 2003, Columbia launched with her crew of seven for a sixteen day SpaceHab science mission. It was to be Columbia's final flight.

Reports said that even here in southern California, we might be able to see Columbia's reentry in the predawn sky, so Cherie and I, along with our friend Adrienne, headed to a spot a few miles from home with a clear northern horizon, hoping to see the incandescent streak of the Orbiter as it was returning to Earth. Unfortunately, it was not to be, as Columbia traveled a bit too far north for us to see. But observers north of us, at the Owens Valley Radio Observatory, were able to shoot a beautiful time exposure, as she headed toward landing in Florida. Unfortunately, this was the last image of OV-102 before tragedy struck. Columbia never made it home, her flight ending in the skies over Texas.

After realizing we had missed seeing the reentry ourselves, we thought all was still well, so got back in the car and headed over to grab some breakfast. Listening to the radio on the way to the restaurant, a report came in that said no one had heard any radio transmissions from the crew, or received data downlink from Columbia for more than ten minutes. At that moment, the realization of what had just occurred hit me

like a sledgehammer. I spun the car around out of the parking lot and headed home.

Debris fell from the sky, and one of the first images of that debris was the cargo bay hatch that Jeff and I had sat in that day nearly three years earlier for our photo inside Columbia. It was devastating, and I can only imagine the anguish those who worked on Columbia every day must have felt in that moment, knowing the orbiter and her seven crew members were gone.

For myself, I prefer to not dwell on her ending, but on all the wonderful achievements Columbia accomplished in her 22 years of service to America's space program. That is what we need to celebrate on this 40th anniversary of the first flight of Space Shuttle Columbia.

Noted surgeon and author Atul Gawande said, "It isn't reasonable to ask that we achieve perfection. What is reasonable to ask is that we never cease to aim for it."

About the Author:

Ms. Michelle Evans (AIAA Distinguished Lecturer): (<https://www.aiaa-lalv.org/september-28-2020-aiaa-member-spotlight-on-michelle-evan/>)

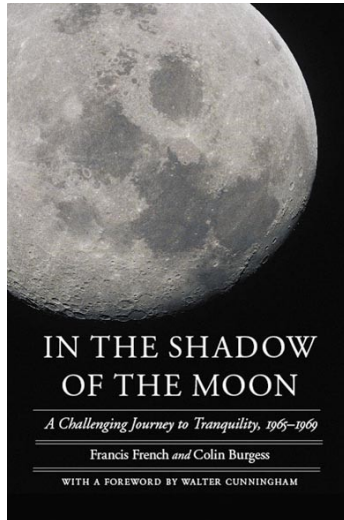
Michelle Evans is the founder and president of Mach 25 Media (www.Mach25Media.com) and is a writer, photographer, and communications specialist in aerospace. She has written the bestselling book "The X-15 Rocket Plane, Flying the First Wings into Space" which was published by the University of Nebraska Press as part of their "Outward Odyssey, People's History of Spaceflight" series.

Michelle's background in aerospace engineering includes serving in the US Air Force working on missile systems, and later in private industry accomplishing environmental testing for systems used in airliners and spacecraft. Her current work with Mach 25 Media provides education and display services for astronaut appearances and other space-related events at government facilities, science centers, schools, and other venues across the country and overseas.

Michelle is a Distinguished Lecturer with the American Institute of Aeronautics and Astronautics, and her book on the X-15 was a finalist for the Eugene M. Emme Award for Astronautical Literature. Michelle received the Diverse Community Leader Award from Orange County Human Relations, and was recognized as one of the 100 Most Influential People in Orange County. She has appeared in numerous publications, including Air & Space Smithsonian, Ad Astra, Orange County Register, Los Angeles Times, and New York Times. Michelle was also a technical consultant on the Neil Armstrong biopic "First Man."

Outward Odyssey Authors Remembering STS-1

(Continued from Page 4)

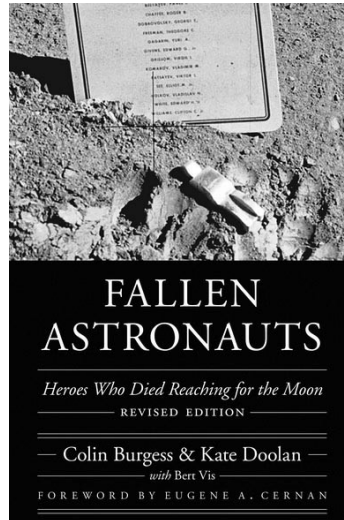


About the Author: Colin Burgess, Author, "Shattered Dreams." Co-Author, "Into That Silent Sea," "In the Shadow of the Moon," and "Fallen Astronauts."

by Jay Chladek

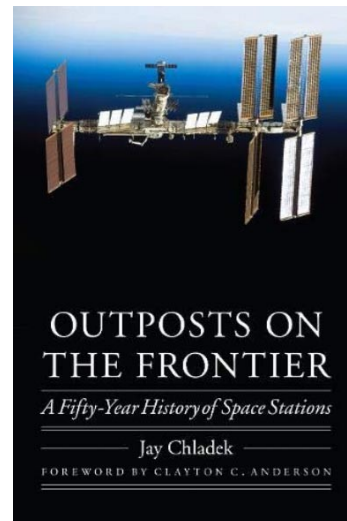
Forty years... where has all the time gone. It was an interesting weekend at KSC in early April as Space Shuttle Columbia, the first fully outfitted orbiter sat on launch pad 39A, awaiting its first launch into space. The crew consisted on John Young and Bob Crippen. John was a veteran of four space flights at the time, including two trips to the moon on Apollo 10 and 16. Crippen was a relative rookie with no spaceflight experience, but he was originally selected as an astronaut for the Air Force's Manned Orbiting Laboratory program before it was canceled and became a sterling support astronaut during the Skylab program. Both men were also U.S. Navy veterans.

I was exactly ten years old at the time. I wasn't born until after Apollo 13's trip and have no conscious memory of seeing any active space mission coverage until shuttle Enterprise did the first glide a few years earlier. When the shuttle program started up, I devoured every book, magazine and image on the vehicle I could find. When the James Bond movie "Moonraker" made it to cable television, I almost drove my parents nuts from watching it so many times and painted my Cub Scouts Space Derby rocket in Moonraker's orange and white color scheme. Columbia didn't have orange stripes, but those black wing chines were pretty distinctive and it was quite a chore to paint them straight on my models back then.



Truth be told, I was asleep for STS-1's launch. I remember the scrub from Friday and I was on a Cub Scout campout that Sunday. Funny enough my dad (serving as an assistant scout master), who had a portable B&W television watched the launch. But he didn't wake me. When we got home that afternoon I was glued to news coverage and held my breath with the rest of the world when payload bay images revealed some tiles were missing from Columbia's OMS pods. But, she made it home safely two days later.

After that, I saw Columbia in person when the ferry 747 stopped at Kelly Air Force Base for fuel. My first model rocket was an Estes Space Shuttle Columbia, which my folks got me for my eleventh birthday. I built it and flew it many times. I even formed a school rocketry club to get my classmates hooked. It seemed like a time when space was the destination and Columbia was in front leading the way until shuttle Challenger came along. But that is a story for another time.



About the Author: Jay Chladek, Author, "Outposts on the Frontier."

by Melvin Croft

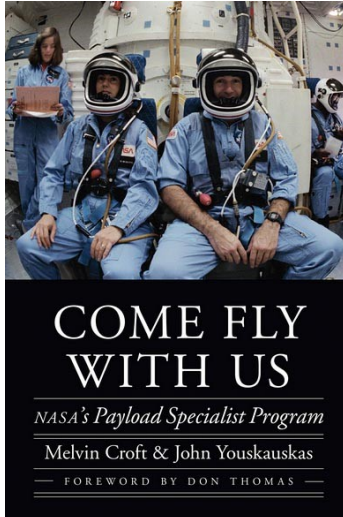
The legacy of the space shuttle has been questioned by many, primarily because it only flew to low Earth orbit. But like many people who gained fame following their deaths, I believe the shuttle will one day be elevated to a much higher status. The program lasted 30 years after the first launch in 1981, and accomplished truly amazing feats; from scientific and medical research to satellite capture, repair, and

(Continued on the next page)

Outward Odyssey Authors Remembering STS-1

(Continued from the previous page)

redeployment to construction of the International Space Station—and over 170 spacewalks! I believe history will be kind to the space shuttle program and the astronauts that flew on those marvelous machines—and it all began with the launch of John Young and Bob Crippen on STS-1!



About the Author: **Melvin Croft**, Co-Author, "Come Fly With Us."

by Michelle Evans

I was raised on the space program, watching John Glenn launch into orbit, Ed White walk in space, and Neil Armstrong plant his bootprints on the Moon. Twelve years after that seminal event, I was very excited to see the beginning of a new era of supposedly routine access to space with the first launch of the Space Shuttle program. Columbia and the flight of STS-1 in April 1981 was to be the start of bringing costs to orbit down, while dramatically increasing the flight rate. However, those promises never materialized because, right from the start, the program was severely underfunded. NASA said they needed about \$10 billion in order to deliver a fully reusable system, so Congress allocated half that amount, while still expecting NASA to deliver everything it promised. Instead, we got a partially reusable system, that was also not only extremely complicated, but also had way too much fragility built into the design.

Just a few months after completing my military service in the U.S. Air Force, and after years of delays, the first launch of the Shuttle was finally drawing near. All of those unrealistic promises were irrelevant to the idea that

for the first time in nearly six years, American astronauts would again be launching into space. Like with so many earlier missions, I got no sleep the night before launch. I remember how bizarre it was that a spacecraft didn't have stages stacked on top of each other, but attached side-to-side.

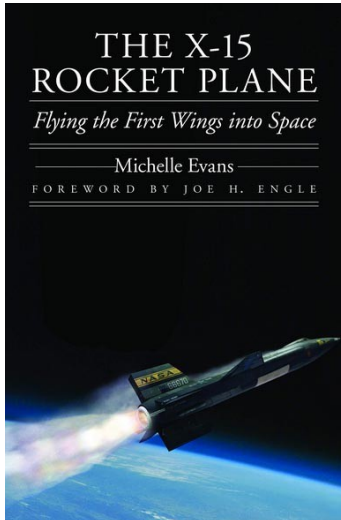
At 7:00 a.m. on 12 April, twenty years to the day from when a human being first launched off the Earth and onto orbit, Columbia roared off the pad. Everything went perfectly, with the exception of losing some tiles off the Orbital Maneuvering System pods near the tail. Some were worried about how this might effect reentry, but two days later all went well as Columbia streaked across the Pacific, crossed the California coast, and circled high above Edwards AFB. As she descended through Mach 1 we heard what would become the distinctive double sonic boom for the first time. I was there on the lakebed, watching it all unfold, the same place where the X-15 rocket plane had landed nearly 200 times, not much more than a decade before. Columbia sailed majestically in front of us, dropped her landing gear, touched down, and left a long rooster tail of dust as she rolled to a halt. A couple of hours later, her crew, comprised of rookie Bob Crippen, and five-time spaceflight veteran John Young, came out to speak to us. Young put our feelings best that day as he said "We're not too far, the human race isn't, from going to the stars."

Over the next thirty years as the Space Shuttle traveled into and out of low Earth orbit, we experienced the tragedy of losing two orbiters and 14 crew members, including Columbia herself. However, we also experienced the exhilaration of watching dozens of spacewalks, satellites being released to orbit, while others were captured or even returned to Earth, probes being launched to the planets, opening the universe to the eye of the Hubble Space Telescope, and the building of a permanently-crewed International Space Station in preparation for longer flights away from our planet to places like the Moon and Mars. John Young's comments that day forty years ago may have seemed premature, but in the long run, I think he will be proven right.

(Continued on the next page)

Outward Odyssey Authors Remembering STS-1

(Continued from the previous page)



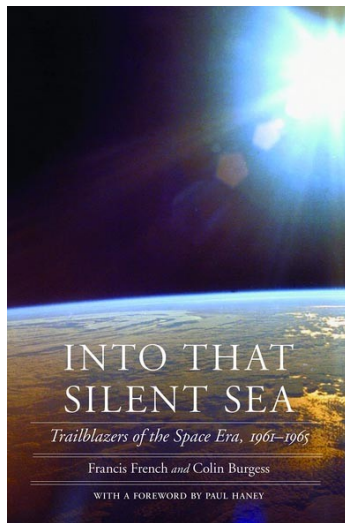
About the Author: Michelle Evans, Author, "The X-15 Rocket Plane."

by Francis French

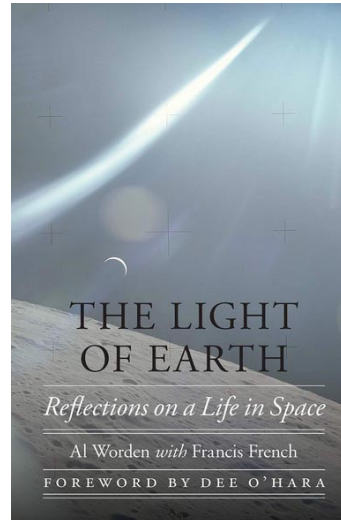
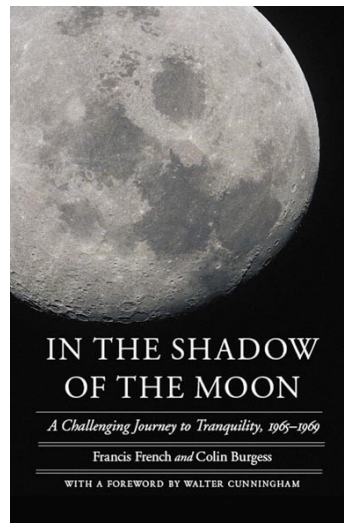
Americans had walked on the moon a decade before, and I'd read about that. But the space shuttle was my era. Aged ten, I sat by the family television, recording the audio with my cassette recorder, waiting for this strangely-shaped assembly of white rocket parts to launch for the first time. I was happy, and constantly calling for my mother to come in and watch with me. If I'd had any idea how dangerous that first shuttle mission was, I'd have been a lot more scared.

Almost two decades later, I saw that same space shuttle—Columbia—with my own eyes as it sat on the launchpad ready for another mission.

I cried.



About the Author: Francis French, Co-Author, "Into That Silent Sea," "In the Shadow of the Moon," "The Light of Earth." Editor, "Apollo Pilot."



About the Author: Francis French, Co-Author, "Into That Silent Sea," "In the Shadow of the Moon," "The Light of Earth." Editor, "Apollo Pilot."

by Chris Gainor

For me, the flight of STS-1 was an encouraging event, mainly because of the strong public interest and support for space exploration shown around that flight. John Young and Bob Crippen's launch in 1981 opened the third decade of human space exploration. The first decade featured the race to the Moon exemplified by a series of more ambitious flights in Earth orbit and then Apollo's reach to the lunar surface with great public interest.

The second decade was quite different. Apollo's increasingly ambitious expeditions to the lunar surface in 1971 and 1972 were met by public indifference, and then both the United States and the Soviet Union turned to space stations. After Apollo-Soyuz, the United States ceded the field of human spaceflight to the Soviet Union for nearly six years. The Soviets, for their part, flew space stations that challenged cosmonauts and controllers, but few people outside the Soviet Union paid attention.

With STS-1, we learned that absence had made the public fonder of spaceflight. The launch day crowds returned to the beaches around the Kennedy Space Center, and public and media interest in the flight of STS-1 rivaled the space program's salad days of Mercury, Gemini and Apollo.

(Continued on the next page)

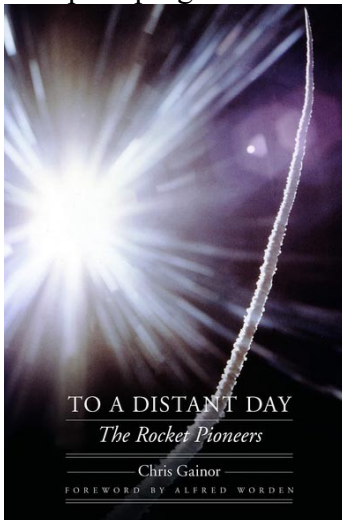
Outward Odyssey Authors Remembering STS-1

(Continued from the previous page)

While as a space enthusiast I looked very forward to this flight, I wondered if I would have much company. It turned out that many people were thrilled by the brand new shuttle, and this interest was maintained in the early years of the program as women and astronauts with non-traditional backgrounds joined shuttle crews.

Inevitably interest fell off over the three decades of the shuttle program, and questions were raised when two shuttles were lost and the shuttle fell short in many ways from the hopes that were held out for it. Despite these problems, shuttle flights advanced the technology of human space travel and scientific discovery with research aboard Spacelab and Spacelab modules and with spacecraft that shuttles deployed and occasionally recovered. Shuttles and their crews built the International Space Station and enabled the scientific exploits of the Hubble Space Telescope.

Four decades after STS-1 and nearly 10 years after STS-135 concluded the shuttle program in 2011, the space shuttle remains in many ways a popular and well known symbol of the U.S. space program.



About the Author: **Chris Gainer**, Author, "To A Distant Day."

by David Hitt

The year is 1975. A Russian spacecraft and an American spacecraft dock in orbit. The next month, I am born, missing the first era of American spaceflight by two weeks.

The year is 1981. A new era of American spaceflight begins. This time, I'm old enough to appreciate it. My father puts me in front of the TV, and we watch STS-1 together. To be honest, my recollection of the event is mostly memory of memory—I remember that it happened more than I remember it happening. But I remember what came next—writing "fanfic" about John Young exploring space. Building models of the shuttle. Desperately trying to win a Space Camp scholarship. I was excited. I was inspired.

The year is 2002. I get a job as a contractor supporting NASA education, writing stories for students and teachers. Many of them are about the space shuttle. I love that I now get to pay forward that inspiration to a new generation of children.

The year is 2005. I am writing "Homesteading Space." Owen Garriott and I interview Bo Bobko and Bob Crippen. In a long career as a writer, I have met national politicians and legendary musicians and men who walked on the moon, but I have never been as starstruck as I was talking to the pilot of STS-1. My exterior remains professional. My interior is an ebullient five year old.

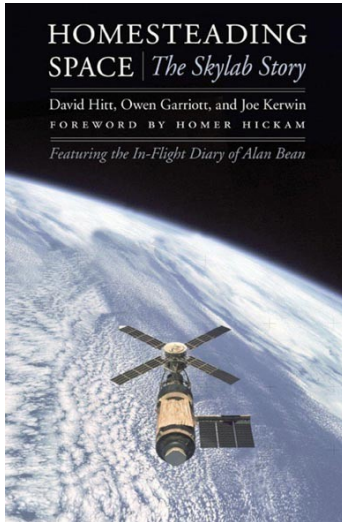
The year is 2013. Bob Crippen writes the foreword for "Bold They Rise." It remains incredible to me to this day that my name and the name of one of those men I watched fly the first shuttle so many years before are on the same book cover.

The year is 2021. I'm celebrating the 40th anniversary of the first shuttle launch. I'm eagerly awaiting another first launch; as NASA's Space Launch System begins stacking for Artemis I; the images of its boosters rising in the VAB echoing very similar images from four decades before. A new era of American spaceflight is beginning. I will watch the launch with my son. His recollection of the event, years from now, will be only memory of memory—remembering that it happened more than remembering it happening. But he will remember what comes next.

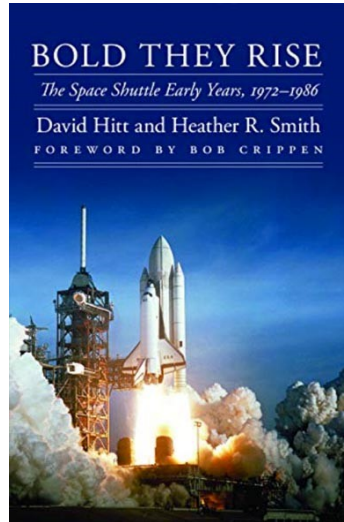
(Continued on the next page)

Outward Odyssey Authors Remembering STS-1

(Continued from the previous page)



About the Author: David Hitt, Co-Author, "Homesteading Space" and "Bold They Rise."



banging frustration after realizing the Shuttle program's blood sucking effect on American planetary exploration.

The final mission in 2011 had me on a mental see-saw:

"Should've been shut down a long time ago."

"But maybe they worked out the kinks already?"

"What a money pit."

"Did it have to end?"

"What are we going to do now?"

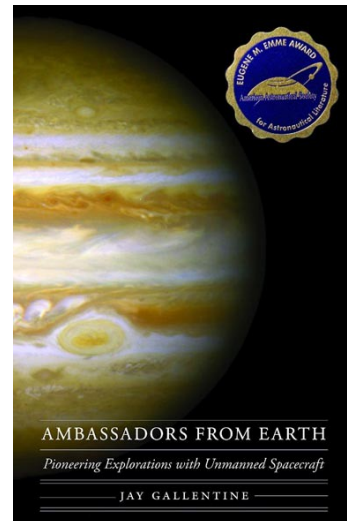
I went to my shelf and picked out one of those Shuttle books I'd bought as an eager ten year-old. Did extra chores to earn money for it. America's Space Shuttle? My very first love. And for a brief instant it was 1981 again – a passionately hopeful time as the unflown machine awaited its new reign in space.

Reflections on the 40th Anniversary of the First Space Shuttle Mission

by Jay Gallentine

I was ten. Had completely missed Apollo. Had spent the last two years reading Shuttle books which all told me it was supposed to be flying already. Up early that Sunday, fiddling with rabbit ears on the basement TV. Finally! With the first launch imminent, my generation's space program could begin at last. I parked in front of the screen with my space Legos and waited.

In no way could I have predicted how my emotions would undulate over the next four decades. They ranged from raw excitement over the initial launches, to sadness after Challenger, to anger over the reasons why, to optimism as Shuttles began going again. Stunned disbelief over Columbia's loss. More anger at the bad calls by NASA management. Positivity after returning to flight a second time. All of which gave way to head-



About the Author: Jay Gallentine, Author, "Ambassadors from Earth."

Outward Odyssey: A People's History of Spaceflight

<https://www.nebraskapress.unl.edu/series/outward-odyssey-a-peoples-history-of-spaceflight/>

Weighing in on Space Shuttle legacy

(based on the AIAA LA-LV STS-1 40th Anniversary event on 2021 April 10)

(Continued from Page 5)

Chris Gainor, who holds a PhD in the history of technology and specializes in writing about space exploration, is president of the Royal Astronomical Society of Canada. His sixth book, *Not Yet Imagined: A Study of Hubble Space Telescope Operations*, was published by the NASA History Program Office. His book *To A Distant Day: The Rocket Pioneers*, was published in 2008.

Jay Gallentine, author of two books, *Ambassadors From Earth* and *Infinity Beckoned: Adventuring Through the Inner Solar System*, focuses his space research on unmanned lunar and planetary programs of the United State and former Soviet Union.

Disagreements on mission values

With the scheduled two-hour Zoom conference clock counting down to overtime, the talk turned from anecdotes and nostalgia to introspection about how some past hard choices and [missteps in space exploration](#) could influence future success or failure.

On one level there was the thought expressed by Gallentine that national government's over-promised and under-delivered ambitions for the orbital Space Shuttle capabilities ultimately redirected resources for robotic systems to explore the universe.

Historian Gainor agreed a lot was achieved in the era of the space shuttle, but he points out a series of flaws brought about in the 1970s by lots of compromises "to save a few bucks." Gainor also said he believes the totality of what was achieved by the shuttle program has never been properly appreciated. Evans said the technical contributions by X-15 test pilot and astronaut Joe Engle and Milt Thompson saved the shuttle program, when they went down to Florida to warn NASA planners not to pursue the idea of adding pop-up jet engines to the space shuttle orbiter for landings. She also said she believes both [the Challenger](#) and Columbia losses were avoidable, had officials applied lessons from the X-15 program to the shuttle orbiters.

There were no quick or easy answers to issues raised. On the one hand, it was argued that spending on space shuttles restricted crewless robotic research. On the other hand, space shuttle crews corrected flaws in [the Hubble Space Telescope](#), resulting in a vastly improved view of the universe and pictures offering meteorologists the tools to deliver more accurate weather forecasts. With an expansive cargo bay and extra-vehicular activity capability, a shuttle orbiter could service, repair and extend the service lives of orbiting satellites, and deliver new satellites into orbit at far less cost than launching atop a conventional rocket.



A timed exposure of the first Space Shuttle, STS-1, at Launch Pad A, Complex 39, turns the space vehicle and support facilities into a night-time fantasy of light. To the left of the Shuttle are the fixed and the rotating service structures. (NASA photograph)

Addressing ongoing arguments over whether the shuttle program was or was not successful, Gallentine said creating the shuttle to accomplish so many kinds of missions required extraordinary risks.

But its success in evolving to accomplish unexpected work over many years, demonstrated that fear born of uncertainty would have paralyzed the overall effort. From its very inception, existing technology raced to meet growing shuttle performance demands, and mostly succeeded. He characterized the situation as "trying to build a 747 with DC-3 technology."

It was pointed out more than once that whatever shortcomings the early model orbiters endured, the Space Shuttle program delivered 22 years of good service to America. And Francis French observed that the Space Shuttle was the only thing flying that couldn't be tested before it was flown. He called the first space flight of Columbia "one of the most dangerous things that was ever done in space."

Bowman saw on television the final landing of the last American space shuttle in the dark of night. He was, he said, "Overwhelmed by a sense of melancholy." Michelle Evans viewed the end of the shuttle program after STS-135 as "an anti-climax." It ended well, she said, but it could have continued, undated "to fix the flaws and get us back faster. It might be flying today."

Chladek remarked, "For 30 years we had a shuttle program, and then, nothing."

Hitt commented that the history of the space shuttle is about half of all human spaceflight's total history, which began with Russian cosmonaut Yuri Gagarin. And Merlin concluded, "The shuttle was flying on borrowed time. It was nine years until we were able to launch our own astronauts into space again."

Touchdown! Landing the first Shuttle Mission

(Continued from Page 6)



Huge crowds flocked to a public viewing site on the eastern shore of Rogers Dry Lake to watch the first space shuttle landing. 320,000 people came to Edwards Air Force Base to witness the landing of Columbia, the first space shuttle. NASA's Dryden Flight Research Center itself hosted 20,000 VIPs. (Air Force photograph)

"Yet the hopes are surprisingly and justifiably high. The economy is supposed to be on its last legs, but that would be hard to prove looking across the country as the country itself looks toward the new year. Pretty heady stuff for a nation that some contend has lost its self-assurance."

Expectations from the flight deck

Maybe more relevant and interesting at the time between liftoff and landing were the before- and after-mission thoughts by two men whose butts sat closest to the new machine a guy named Murphy warned pilots about: John Young and Robert Crippen.

Asked in a preflight news conference if he was nervous about making the first space shuttle flight, mission commander Young said:

"Anyone who sits on top of the largest hydrogen-oxygen fueled system in the world, knowing they're going to light the bottom, and doesn't get a little worried, does not fully understand the situation."

Between launch and landing, Columbia pilot Bob Crippen said for the record:

"This vehicle is performing like a champ. I've got a super spaceship under me."

Their collective four feet back on the ground at Edwards, Crippen said, "What a way to come to California." Young left it at, "The dream Is alive."

Construction began on Columbia in 1975 at North American Rockwell's assembly facility in Palmdale and arrived at the Kennedy Space Center in early March 1979. Columbia was scheduled to launch in late 1979 but

was delayed by problems with the RS-25 rocket engine and the thermal protection system. Eight thousand of Columbia's 30,000 heat shield tiles were yet to be installed. About two years later, on March 19, 1981, the launch was again delayed when three workers were killed by asphyxiation after a ground test, delaying the launch until April 12.

The Spoken Word III: Recollections of Dryden's History; The Shuttle Years

With mainstream media's episodic and short-term fixation on fast-moving, shiny objects, the authentic and richly detailed story of Space Transportation System (STS-1) mission to advance exploration of space is hidden in plain sight on NASA archival websites.

The third volume in NASA Dryden's series of oral histories collected from its workforce focuses on the space shuttle, spanning nearly three decades. According to Chief Historian Christian Gelzer, it is institutional memory covering the period, starting with space shuttle approach and landing tests in 1977 — but beginning with wingless lifting bodies and the X-15s, critical antecedents to the space shuttle. This volume delivers, in their own words, the experiences of NASA Dryden and Air Force people who made it all happen.

Standing on the shoulders of men and women who designed, built, tested and perfected the North American Aviation-built X-15 rocket plane and a series of increasingly successful wingless lifting bodies that grew from a plywood-covered frame towed by a car, NASA selected the prime contractor to build the first space shuttle orbiter on July 26, 1972.

The Space Transportation Systems Division of Rockwell International in Downey, Calif., won the contract, and Palmdale's former North American Aviation factory on Air Force Plant 42 would do the assembly.

With more than 250 major subcontractors involved, Rockwell's Palmdale assembly facility is where all component parts, pieces, and systems of the Space Shuttle came together for final assembly and testing. Major airframe sub-assemblies came from as far away as New York, Ohio, Missouri, Oklahoma and California plants in Downey and San Diego.

(Continued on the next page)

Touchdown! Landing the first Shuttle Mission

(Continued from the previous page)

Then came the job of handing off the finished product to NASA for delivery by truck to Dryden Flight Research Center at Edwards, where the spacecraft was loaded atop a modified Boeing 747 Shuttle Carrier.

Pride of the Antelope Valley

Long before the shuttle flew, its first act in drawing a large crowd came on the day it was driven the roughly 36 miles from Palmdale to Edwards, a day remembered by one of the chief movers, Joe D'Agostino, who later served as NASA's Shuttle Program manager.

D'Agostino told archive interviewers, "The most important thing to remember during those days was the reaction of people in that environment as opposed to today's environment, which is security.

"It was completely different then. I used to say the people in the Antelope Valley were special because they had built the orbiter, it was their pride, they had relatives, friends that had worked on the orbiter. It was one of the premier programs in the Valley and they all felt it was part theirs.

"Moving it was a very festive time. I saw things that I didn't expect: Kids up on fences with flags waving, parents that actually let their children get up on some of the 6-foot block walls; kind of worried they might fall off but still, very enthusiastic, clapping, smiling, hoorahs, waving a flag.

"We didn't worry about terrorist activity; we were aware that we certainly didn't want anything to happen and were looking for people running across the route, because we had those – people would cross the road in front of us. We'd be coming up the street and they wanted to get in front, people wanted to get pictures. It was a different era."

D'Agostino told his interviewer that moving the first shuttle Enterprise took about 12 hours, starting at 4:30 a.m. and finishing between 3:30 and 4 p.m. But he added, "We got better. The next one was Columbia."

And then came the first of two successively larger crowd scenes when Shuttle Orbiter Enterprise was air-dropped from its modified Boeing 747 Shuttle Carrier Aircraft on Aug. 12, 1977, for an unpowered landing on the lakebed.

The really big event Joe D'Agostino would never forget came with STS-1's return to earth. D'Agostino remembered, "Masses of people from up and down the

West Coast had started lining up at the base's gates the day before the landing. NASA Armstrong, Air Force, and industry employee families arrived first and a big camp-out was in full swing. Tents popped up everywhere. Campfires, bonfires, marshmallows roasting, barbecues toasting — the whole thing.

"In addition to our employees and those of Rockwell, people of the Antelope Valley who saw Shuttle Columbia towed down the streets of Lancaster on the way to Dryden for the ferry flight to Kennedy now came out to see it return from space," D'Agostino said. "It was a real personal thing."

At midnight, Air Force officials opened the gates, and the public swarmed in, headed for an area set aside for public viewing. Nobody was sure how many visitors came in. Estimates ranged from 200,000 to 300,000.

Officials had to open the east lakeshore of Rogers Dry Lake for the first time. Campers and RVs arrived by the hundreds, growing into the thousands.

Something as basic as safety and security planning and operations raised by that human wave pointed out the remarkable capacity of vastly different public and private organizational cultures and managerial styles to basically get along and get the job done — at a price. How working relationships involving so many intertwined organizations even managed to survive remains one of the unsolved mysteries of the Space Shuttle era.

Joe D'Agostino came to Dryden with Air Force security experience. His role at NASA culminated with his final position as shuttle program manager for Dryden until his retirement.

He told interviewers, "The only thing that drove me crazy was the public affairs people who always wanted to be right there, on the spot. When I became the lead of all the shuttle stuff, I made the comment that it is real difficult meeting the requirements of the security people and the public affairs people because they come from two different environments and the analogy I used was, 'The people in operations are happy if the public affairs people are never near the runway, and the public affairs people aren't happy unless they're under the wheels of the orbiter during landing.' Some decisions I made when I had joint responsibility for both, didn't make either party happy because I had to find some kind of a medium

(Continued on the next page)

Touchdown! Landing the first Shuttle Mission

(Continued from the previous page)

and I had been used to the Air Force days where public affairs was part of the group and the team. At Dryden the security and the public affairs people seemed, from day one, to be on opposite ends. Later on it became a team effort.”



The Antelope Valley Inn in Lancaster, Calif., celebrates the Space Shuttle Columbia's first landing at nearby Edwards AFB on April 14, 1981. Columbia was built in the Lancaster area. (NASA photograph)

Working relationships

Johnny Armstrong, who worked for the Air Force Flight Test Center on the X-15 and lifting bodies with NASA Dryden, told archivists it was an obvious extension when the shuttle came along, “to continue to work with them with our good working relationship we had all those years.”

During the X-15 program, Armstrong was a flight planner who also trained pilots in a simulator that extended into the lifting body program, as well as space shuttle. He said few people realized the AFFTC even had a simulator for early studies of both the Approach and Landing Test and the orbital flight test landing phase.

Armstrong explained that shuttle pilot and former X-15 driver Joe Engle came back to Edwards to build data maneuvers that he performed during re-entry. “You gotta remember that Joe was the only individual who ever flew the shuttle hands-on all the way from de-orbit burn through landing,” Armstrong said. Data extracted from Armstrong’s X-15 experience was used to compare wind tunnel predictions.

Armstrong said Engle then went to Houston, adding, “We had developed very close relationships with the engineers at Houston, who really weren’t airplane testers, but began to learn real fast, and we worked together with all the team members: Dryden, Johnson Space Center (JSC) and the Flight Test Center. The Flight Test Center was interested because they were essentially hired by what’s now called Space Command, but it was Space Division down in El Segundo, because the Department of Defense was going to have heavy payloads in that shuttle.”

Asked about the DOD-NASA-Air Force relationship, Armstrong remembered, “That relationship was compelled by the DOD payload requirements, and once they formed that team we did, too ... We were still the same team just trying to work to make something fly better, that happened to be called the space shuttle.”

Earlier roles played by NASA Dryden and Edwards AFB in successful creation of the Space Shuttle Orbiters extended into dozens of scientific fields of research, including flight control computer software, and drag chutes, special tires and brakes for landing. There was even geological research to assure the dry lakebed was strong enough to support a landing space shuttle coming in hot and fast, weighing in at 140,000 to 200,000 pounds.

Of necessity, those and hundreds of other tests were carried out by existing aircraft equipped to validate space shuttle design concepts and configuration more than a decade before testing began with the prototype Enterprise. In addition to knowledge gleaned from the X-15 and lifting body programs, the Space Shuttle Orbiter evolved from experience from conventional surrogates including: F-8, F-104, F-106, and F-15; YF-12A; B-52; Convair CV-990 jetliner, and even a variety of civilian jets.

Dryden had a wealth of data to support selection of two Boeing 747 shuttle carrier aircraft to transport orbiters between launch and landing locations, as well as X-15 program data on aerodynamics, structures, thermal properties, and flight controls that quickly found its way to designers and engineers in space shuttle development.

(Continued on the next page)

Touchdown! Landing the first Shuttle Mission

(Continued from the previous page)

High Speed Research developed a central airborne performance analyzer that monitored aircraft maintenance parameters. The analyzer detected problems arising in flight and provided enough information for pilots to decide whether to abort the mission or continue. The analyzer also provided data for post-flight maintenance checks. Though it was just a research project, the analyzer was a forerunner to on-board diagnostic systems used on the space shuttles and on a variety of aircraft today.

Fly-by-wire made it happen

In 1972, Dryden began research flights with the first aircraft equipped with an all-electric, digital flight control system, the F-8 Digital Fly-By-Wire, which used electrical impulses instead of mechanical means to link cockpit controls and actuators moving flight control surfaces.

This same all-electric F-8 was used to test and verify computer hardware and software used in the space shuttle's flight control system before the first orbital flights began. That test program led to a stunning development throughout the aerospace world: The Glass Cockpit.

Early in his career at Dryden, Kenneth J. "Ken" Szalai was principal investigator on the F-8 Digital Fly-By-Wire program. He later became Deputy Director and then Director of Dryden.

With degrees in electrical and mechanical engineering, Szalai confronted the digital challenges of making onboard flight controls and instrumentation reliable in flight or in space. One of those problems was how to restart a computer if it zeroed-out and there was a delay in regaining control, followed by a backup system transfer that endangered the aircraft. Szalai recalled, "Someone told me: 'This doesn't actually happen in the real Apollo computer.' Turns out, it does."

Szalai and a few other people constituted a Source Evaluation Board for a computer to use in the F-8 and ultimately the shuttle. Asked how he would rate the F-8 program from a technology transfer standpoint, he answered "I think it was extraordinarily effective at technology transfer."

Perspectives from the sidelines

Peter W. Merlin, who years later came to work at Dryden, was in elementary school in April 1981. He remembers, "America hadn't put an astronaut in orbit for more than five years. The shuttle was something entirely new. It wasn't just a rocket; it had started out that way, but it came back like an airplane.

"The public was really excited about this new vehicle and almost 300,000 people turned out to see the landing at Edwards Air Force Base. I was one of them. I got there pretty early, managed to get myself a good spot to watch. It was so crowded down in the main area on the East shore of the lakebed that I climbed up on a nearby hill so I had a bird's eye view, panoramic view of the whole lakebed and the runways.

"There were people still pouring in up until the time the thing landed and not everybody got into the public viewing site. There were hundreds of cars strung out along Mercury Blvd., which goes along the edge of the lakebed. As soon as the shuttle touched down and came to a stop, someone along Mercury Blvd. decided they were going to try and get close to it. They took off across the desert heading towards Columbia. A whole bunch of other vehicles followed. It was like a stampede. I'd never seen anything like this.

"The Air Force security had a couple of helicopters and several jeeps all trying to turn these people back. I watched the cars racing along the lakebed and every now and then one would make a turn, dust flying up as the helicopter or one of the jeeps turned them around. Somebody on a motorcycle got pretty close. I don't know how close they got to Columbia but they turned them around. They kept it pretty quiet. You never hear about that."

Another eyewitness that morning was Mojave resident and congressional staff member William "Bill" Deaver, who drove to Lancaster in the middle of the chilly night to board a VIP bus bound for Edwards. "The driver couldn't turn off the air-conditioner," Deaver recalled. When the sun came up, Deaver said one of the first things he noticed was "the media guys, all wearing suits and ties, out there in the dirt and the dust with the wind blowing." He added that by the time the shuttle landed, "they were brown from their shoes up to their knees."

(Continued on the next page)

Touchdown! Landing the first Shuttle Mission

(Continued from the previous page)

A veteran newsman for much of his career, Deaver expressed admiration for the NASA public relations staff's smooth handling of the media and politicians, pointing out that NASA couldn't afford to offend the folks who voted for NASA's budget requests.

Into the future

While April 1, 1981, is almost universally perceived as the birthday of America's space shuttle era, the radically novel Columbia spacecraft was born with a technological maturity that made it age quickly in a public mind accustomed to quick changes for the next big thing.

Columbia would make three more test flights, developing and demonstrating its mission and payload capabilities before going on to fly more than 135 missions throughout 30 years of service. It would land at Edwards AFB several more times in the decades that followed.

Enterprise, rolled-out in September 1976, was the first of six shuttle orbiters to be built by serially-merging aerospace contractors: North American Aviation, which begat North American Rockwell International, which

became Boeing. Enterprise, a testbed/prototype, was retired. The additional five, including Columbia, were: Challenger in 1983; Discovery in 1984; Atlantis in 1985; and Endeavor, first launched in 1992.

In the five years following 1981's space shuttle grand opening, shuttle missions expanded in frequency, endurance and scientific discovery. Yet national media interest cooled and the public began to accept space shuttle flights as a matter of routine. Then came Jan. 28, 1986, when Challenger exploded just after launch from Cape Kennedy, killing all aboard. The shuttle fleet was grounded until 1988. Disaster struck again on Feb. 1, 2003, when Columbia broke up on approach to landing in Florida, again claiming the lives of all aboard.

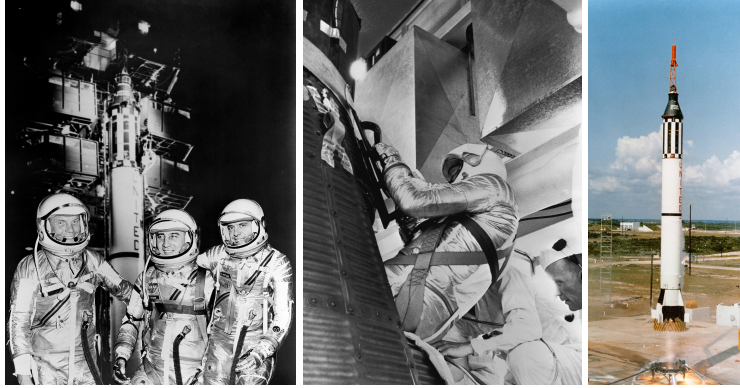
Near the end of his second term in office, President George W. Bush decided to retire the Shuttle orbiter fleet in favor of the Constellation program and its envisioned crewed Orion spacecraft.

Constellation was later canceled when President Barack Obama signed the NASA Authorization Act of 2010.

60 Years Ago: Alan Shepard Becomes the First American in Space

(Continued from Page 7)

schedule another uncrewed test flight on March 24. That successful flight cleared the way for the flight of the first American astronaut. But on April 12, the Soviets stole the prize by launching cosmonaut Yuri A. Gagarin aboard his Vostok capsule, in which he completed a single orbit around the Earth.



Left: John H. Glenn, left, Virgil I. "Gus" Grissom, and Alan B. Shepard, the astronauts selected for the first suborbital mission. Right: Shepard climbing aboard Freedom 7 on launch day. Right: Liftoff of the Redstone rocket carrying Alan B. Shepard, the first American in space, aboard Freedom 7.

After hundreds of hours of training in simulators, and three simulations inside the capsule itself, Shepard and his backups Grissom and Glenn prepared for the actual flight. Inclement weather scrubbed the first launch attempt on May 2, 1961, and NASA decided it was time to announce that Shepard would indeed be making the first flight. On May 5, the weather proved more cooperative and Shepard climbed aboard Freedom 7 atop the Redstone rocket poised on Launch Pad 5 at the Cape Canaveral Air Force Station, now the Cape Canaveral Space Force Station, in Florida. Half a million people had gathered on nearby beaches to watch the launch in person. An estimated 45 million Americans anxiously watched the liftoff on live television, including President Kennedy at the White House. After more than two hours of delays due to technical issues, the rocket engine ignited at 9:34 a.m. Eastern time, propelling Shepard skyward and into the history books.

During the mission, Shepard communicated with the Mercury Control Center (MCC) at Cape Canaveral. Flight Director [Christopher C. Kraft](#) designed the control center to monitor every aspect of the mission. Fellow astronaut Slayton served as the capsule communicator, or



Left: In the White House, President John F. Kennedy, center, anxiously watches the launch of Alan B. Shepard, as Vice President Lyndon B. Johnson, left, and First Lady Jacqueline Kennedy look on. Right: View of the Atlantic Ocean taken during the flight of Freedom 7.

capcom, speaking directly with Shepard in Freedom 7. The Redstone rocket's engine shutoff as planned 2 minutes, 22 seconds after liftoff, with the launch escape tower jettisoning immediately thereafter. After another 10 seconds, the spacecraft separated from the booster, and Shepard began to experience weightlessness. At 3 minutes 10 seconds into the flight, Shepard took over manual control of the spacecraft's attitude and found that he could control Freedom 7's orientation with remarkable ease and precision. He conducted visual observations of the Earth below and took some photographs of the cloud-covered Atlantic Ocean. At 5 minutes, 11 seconds, Freedom 7 reached the highest point of its ballistic flight at 116 miles and began descending toward the Earth. Fifteen seconds later the retro-fire maneuver took place. At an altitude of 230,000 feet, Freedom 7 encountered the top layers of the Earth's atmosphere, ending Shepard's time in weightlessness after five minutes. During the deceleration, he experienced g-loads of up to 11 times the force of Earth's gravity, but only for a few seconds. A drogue parachute deployed at 22,000 feet to slow and stabilize the spacecraft, followed by the main parachute at 10,000 feet. A landing bag deployed at the bottom of the spacecraft to further cushion the impact, and after a flight of 15 minutes 22 seconds, Freedom 7 splashed down in the Atlantic Ocean north of the Bahama Islands and 300 miles southeast of Cape Canaveral, completing Shepard's flight as the first American in space.

(Continued on the next page)

60 Years Ago: Alan Shepard Becomes the First American in Space

(Continued from the previous page)



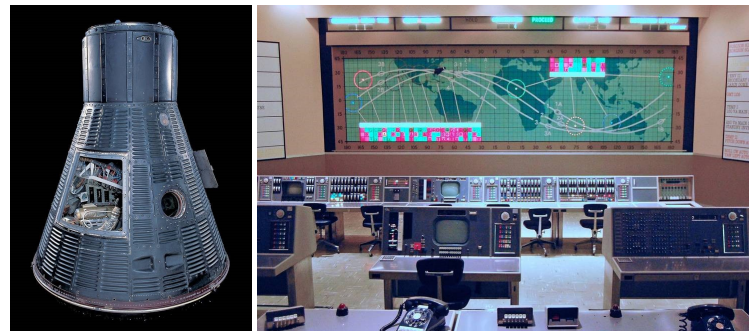
Left: Helicopter from the U.S.S. Lake Champlain hoists Alan B. Shepard from his spacecraft following splashdown. Middle: View of Shepard's recovery from the helicopter. Right: Shepard aboard the Lake Champlain with his Freedom 7 capsule behind him.

Freedom 7 splashed down just four miles from the prime recovery ship – an aircraft carrier called the U.S.S. Lake Champlain (CVS-39). Recovery forces deployed from the Lake Champlain and retrieved Shepard and his capsule within 20 minutes of splashdown and delivered them onto the flight deck. Shepard went below decks for a brief medical exam and a congratulatory phone call from President Kennedy. At a press conference afterward, the President hinted that he would soon be seeking more funding for a greatly expanded space program. Less than two and a half hours after arriving aboard the Lake Champlain, Shepard boarded a plane that took him to the Grand Bahama Island for more in-depth medical examinations. Meanwhile, a helicopter retrieved Freedom 7 from the Lake Champlain and delivered it to Cape Canaveral. After initial inspections, the capsule traveled to Paris to go on exhibit May 25 at the International Aeronautical Show.



Left: President John F. Kennedy pins TBS medal to congratulate Alan B. Shepard, the first American in space. Right: President Kennedy addresses a joint session of Congress and commits the nation to landing a man on the Moon and returning him safely to the Earth before the end of the decade.

On May 8, 1961, Shepard arrived at the White House where in a ceremony in the Rose Garden President Kennedy presented him with NASA's highest award, the Distinguished Service Medal. From there, Shepard with his wife Louise riding in Vice President Lyndon B. Johnson's limousine took part in a motorcade that took them to the Capitol for a reception with lawmakers. On May 25, President Kennedy returned to the Capitol to address a joint session of Congress. During the [speech](#), he stated that the United States should "commit itself to achieve the goal, before this decade is out, of landing a man on the Moon and returning him safely to the Earth." That risky commitment, based on a single 15-minute suborbital spaceflight, culminated with the landing on the Moon of Apollo 11 on July 20, 1969.

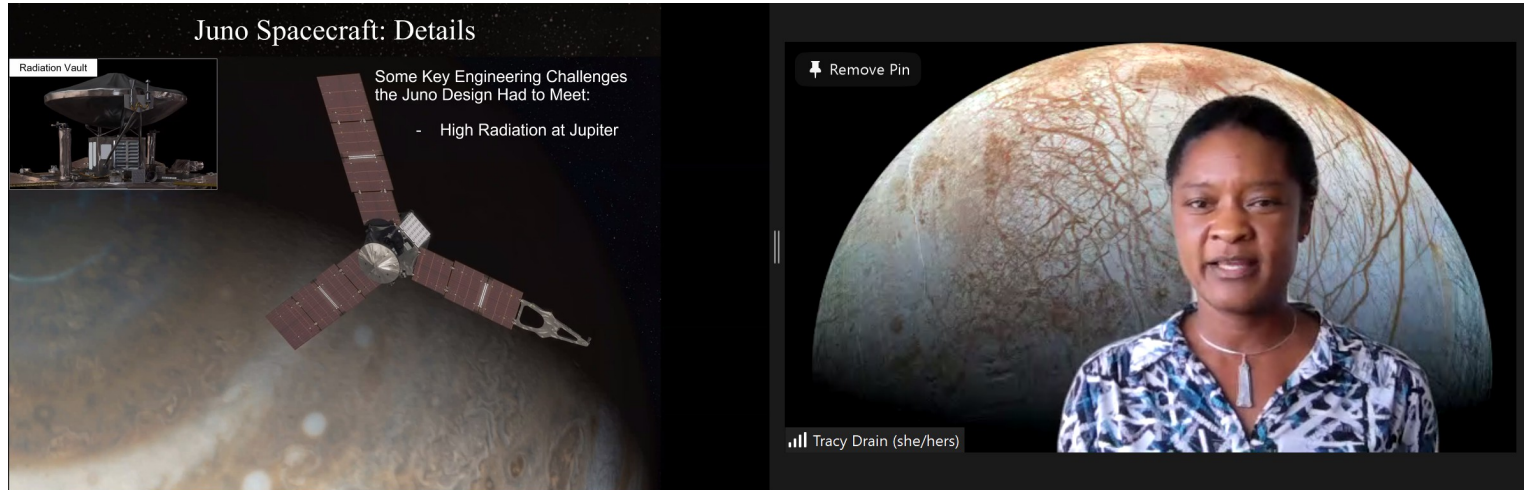


Left: The Freedom 7 capsule at the Smithsonian's National Air and Space Museum Stephen F. Udvar-Hazy Center in Chantilly, Virginia. Credit: Image courtesy of Smithsonian's National Air and Space Museum. Right: A recreation of the Mercury Control Center at NASA's Kennedy Space Center's Visitor Complex.

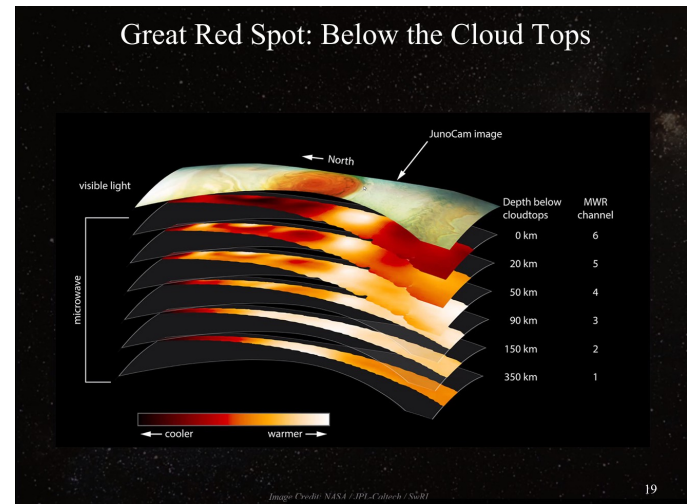
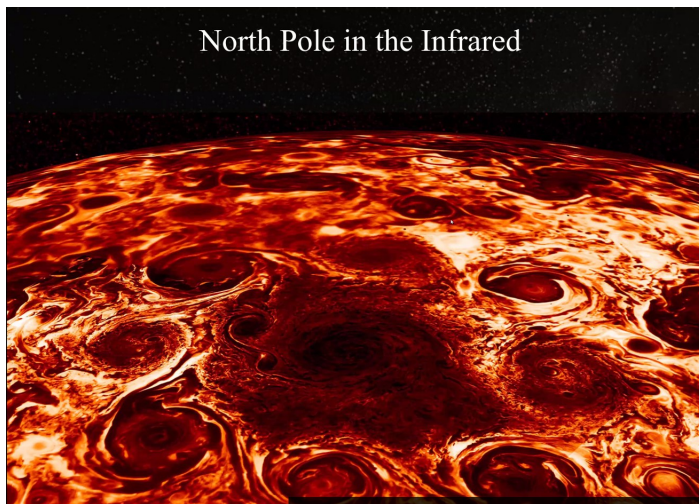
The Freedom 7 capsule is on display at the Smithsonian's National Air and Space Museum [Stephen F. Udvar-Hazy Center](#) in Chantilly, Virginia. A recreation of the MCC is on display inside the Kurt Debus Center at NASA's [Kennedy Space Center's Visitor Complex](#).

AIAA LA-LV New Space mini-Conference 2021 (2021 April 17)

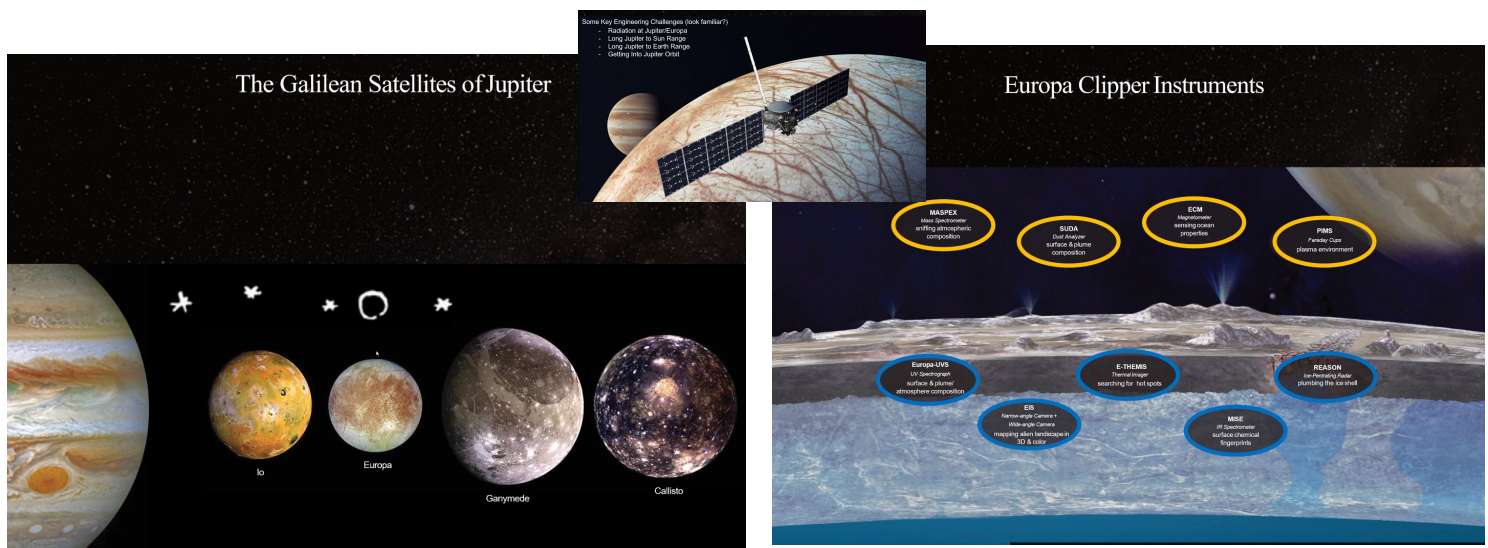
(Continued from Page 10)



Ms. Tracy Drain (right, NASA JPL) sharing the excitement of the June Mission to Jupiter. and the engineering & scientific accomplishment of the Mission.



Tracy showing her favorite scientific discoveries of the June Mission: The North Pole of Jupiter (Left), and the Great Red Spot in 3D (Right).



Ms. Drain showing the exciting explorations for the Galilean Moons / Satellites of Jupiter: Io, Europa, Ganymede, and Callisto (left), the proposed Europa Clipper Spacecraft (upper middle), and the proposed Instruments for the Europa Clipper.

(Continued on the next page)

AIAA LA-LV New Space mini-Conference 2021 (2021 April 17)

(Continued from the previous page)



Mr. Stephen Eisele (right, Vice President Virgin Orbit, Afternoon Session Keynote Speaker) talking about Virgin Orbit's projects and development and Mr. Richard Branson's passion for space and leadership, also mentioning a touching story about Mrs. Eve Branson, who passed away a few days before the success of the LauncherOne earlier this year, as if she was blessing/protecting the mission. AIAA LA-LV and the attendees sent the deepest condolence, and the best wishes to Mr. Branson, via Mr. Eisele.



Mr. Eisele talking about the goals and approaches of Virgin Orbit, launching satellites from a commercial aircraft anywhere. It's truly a leading company and model for New Space, also demonstrating the fun and importance of New Space.



The successful Orbital Mission for LauncherOne on 17 January, 2021 was not only a major demonstration of commercial New Space operations by deploying all payloads successfully, it also pushed the Technology Readiness Level (TRL) to 9. It was truly a big mission success for celebration! Congratulations! Virgin Orbit!



(Continued on the next page)

AIAA LA-LV New Space mini-Conference 2021 (2021 April 17)

(Continued from the previous page)

Two Opportunities:

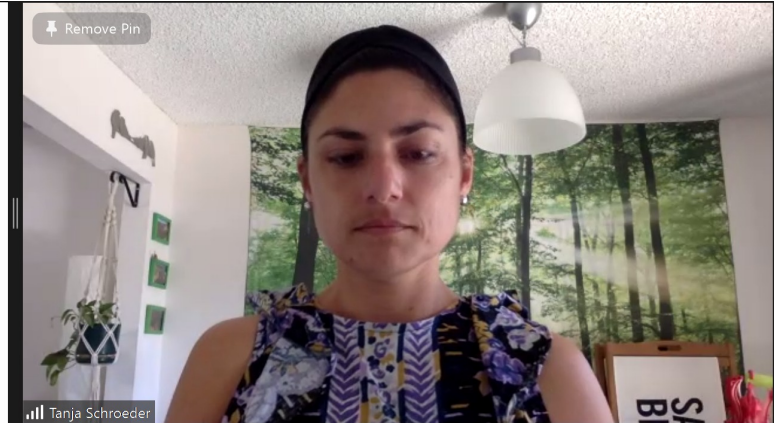


Teaching Fellowship

- Pathway to becoming a Full Time Teacher
- High Needs Schools
- Flexible timeline
- California/ Colorado

STEMx

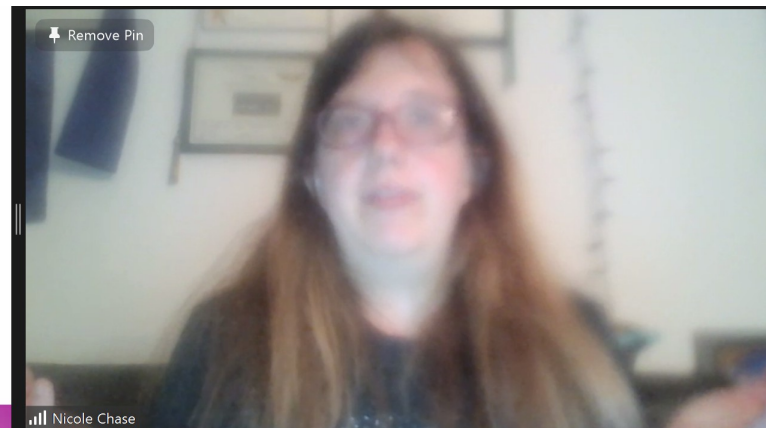
- Virtual Math Tutoring
- High Needs Schools
- Volunteer run
- 2 hours a week/ Semester
- Flexible
- National Program



Ms. Tanja Schroeder briefing as an exhibitor, talking about the EnCorps' mission and their STEM Teachers Program, via the Teaching Fellowship and the STEMx opportunities.

AGENDA

- Introduction
 - What is SEDS?
 - What is SGAC?
- Demographic-related results from the survey
- Non-demographic results from the survey
- Future considerations
- Questions to ponder



Ms. Nicole Chase talking about SEDS and SGAC, and the importance for including the young generations.

Overview

- Setting the Stage
- Background on Artificial Intelligence (AI)
- Selected Applications of AI in Space Systems
- Considerations
- Q & A



a little bit. But what I hope to cover is not necessarily a specific deep dive on cutting edge artificial and.

Brendan Rosseau



Mr. Brendan Rosseau and Mr. Parker Saussy (both from Booz Allen Hamilton) briefing about the article that submitted for this AIAA LA-LV new Space mini-Conference 2021 addressing the importance of AI and the challenges & implications for it.

(Continued on the next page)

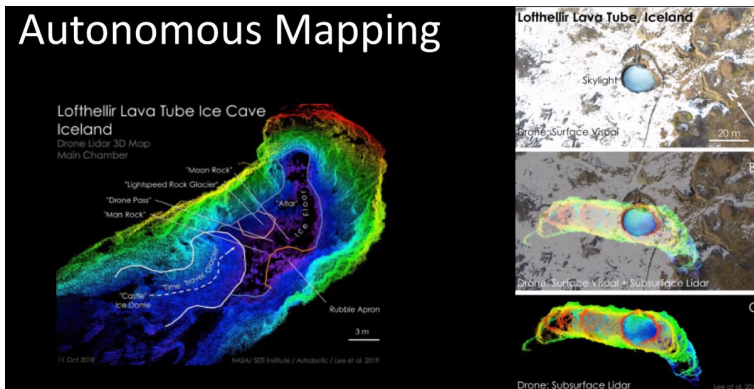
AIAA LA-LV New Space mini-Conference 2021 (2021 April 17)

(Continued from the previous page)

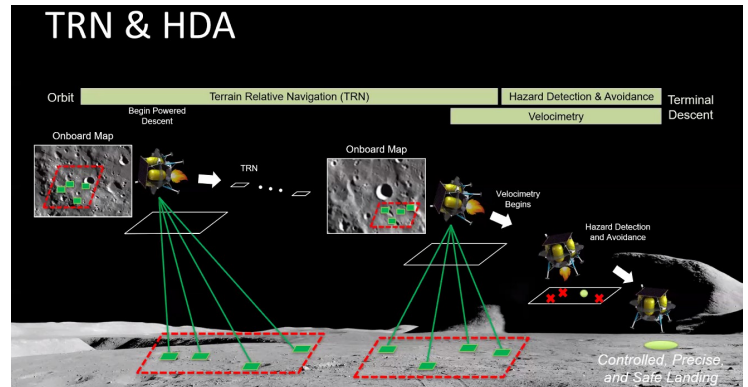


Mr. Daniel Gillies (Griffin Mission Director, Astrobotics) giving a site tour / field trip for Astrobotics grand-opening facility in Pittsburgh, PA.

Autonomous Mapping



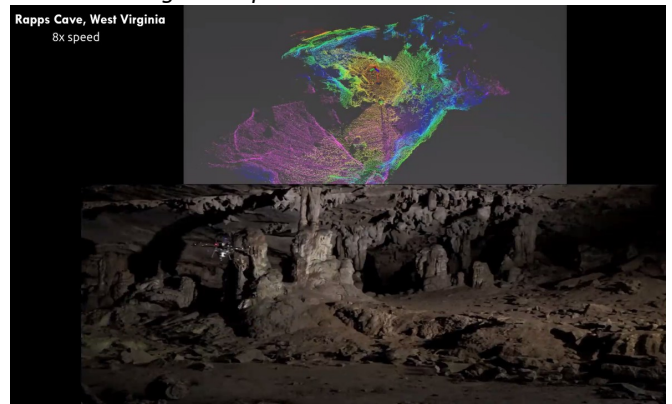
TRN & HDA



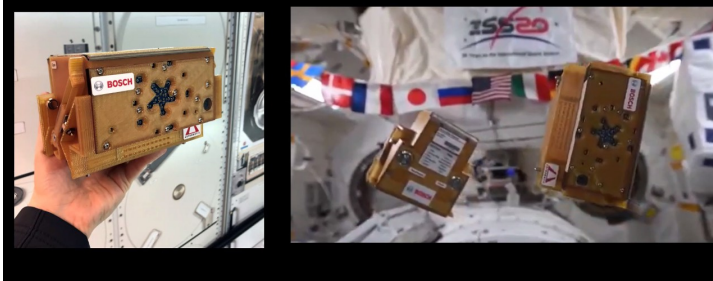
Mr. Gillies talking about Astrobotics' AI capabilities for lunar landing and explorations.



Mr. Gillies showing Astrobotics' goals/mission and the demo for their rovers' AI capabilities for caves and difficult terrains.



SoundSee



Astrobotics' products have been used in space, with also their new lander fleet and CubeRover services. (Continued on the next page)

ASTROBOTICS PROGRAMS

End to End Delivery Services

LANDERS

Peregrine
Surface payload: 100 kg

Griffin
Surface payload: 500+ kg

ROVERS

CubeRover
Surface payload: 2-6 kg

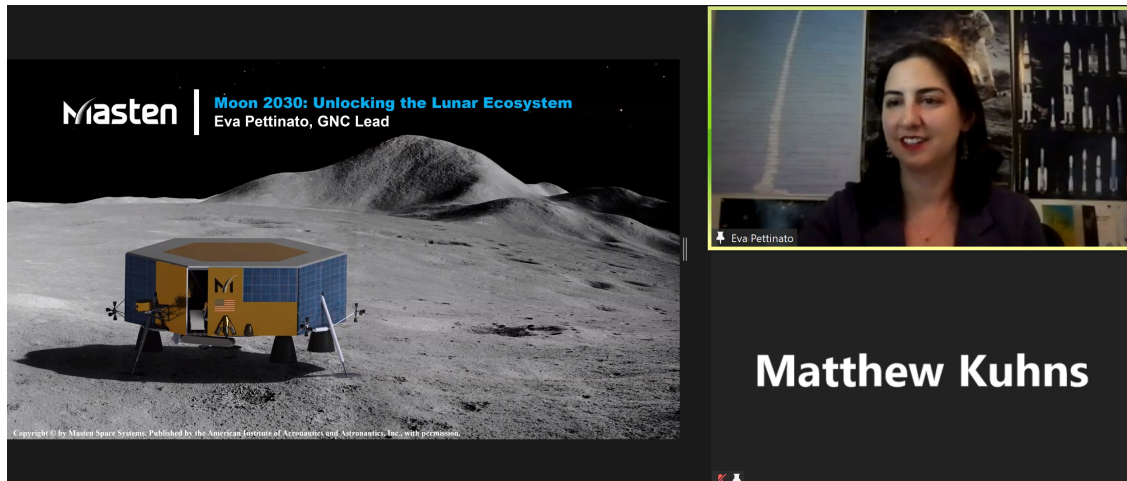
Polaris
Surface payload: 90 kg

CUBEROVER SERVICES



AIAA LA-LV New Space mini-Conference 2021 (2021 April 17)

(Continued from the previous page)



Ms. Eva Pettinato (Masten) talking about Masten's goal and visions for Space, with Masten's VP of Research commenting occasionally.

FAST Landing Pads

Mitigating lunar dust

Flight Alumina Spray Technique (FAST) landing pads use rocket spray to inject feedstock particles into the rocket engine nozzle & coat the landing area prior to landing.

Advantages:

- Minimizes harmful dust particles & limits regolith displacement
- Allows vehicles to land near existing surface infrastructure
- Enables more landing locations for complex lunar, Mars, and asteroid missions
- Prevents deep cratering plume effects for better science

The image shows two side-by-side illustrations of a lunar lander. The left one is labeled 'Lunar landing without FAST' and shows a large, dark plume of dust being kicked up by the lander's engines. The right one is labeled 'Lunar landing with FAST' and shows the lander with a spray of particles from its engines, which appears to coat the landing area and reduce the dust plume.

Metal Oxidation Warming System

Surviving the lunar night

A warming system that employs a chemical reaction to deliver heat through the oxidation of various metals, such as lithium, aluminum, and magnesium.

Advantages:

- Allows landers, rovers, and payloads to survive the lunar night (350+ hours)
- Enables continuous operations in permanently shadowed regions (craters reach -382°F)
- Dust-proof & non-radioactive; Safer, lighter and more robust than nuclear alternatives
- More efficient and cost-effective than generators and battery-powered heaters

The image shows a 3D model of a cylindrical device with various pipes, valves, and a central heating element, representing the Metal Oxidation Warming System.

Ms. Pettinato showing some of the new technologies Masten development for Artemis, such as FAST and a Metal-Oxide Heating Device.

Future Lunar Ecosystem

Enabling sustainable utilization of the Moon & beyond

The diagram illustrates a sustainable lunar ecosystem with various components: Satellite communications, Reusable landers, Terrestrial testing, Sample return, Resource extraction equipment, Lunar habitats, Landing pad technology, and Refueling supplies & infrastructure.

Masten Overview

What. Masten is a rocket company enabling sustainable utilization of the Moon, Mars, and beyond.

How. Our unmatched flight experience, agility, and iterative approach allows us to accelerate the realization and impact of space ecosystems.

Why. We aim to unlock the value in space to benefit humans on Earth.

The image shows a rocket launching from Earth, with a large plume of fire and smoke coming from its engines.

Ms. Pettinato presenting the complete solutions Masten can provide for the lunar robotic and human exploration and the Artemis missions.

Masten Solutions

Developing, testing, and delivering technologies to accelerate space ecosystems

Terrestrial Testbed

Testing and iterating space technologies aboard our terrestrial testbeds to increase technology readiness and reduce risks for space missions.

Lunar Delivery

Providing full mission services to safely deliver payloads aboard our lunar landers.

Tech Development

Developing new tech and modifying tech from other industries to solve the most pressing space exploration challenges.

The image is a grid of small images showing various technologies and testbeds, including Xombie, Xole, Xaero-A, Xaero-B, Xodiac, Xopdior, XL-1, XL-2, XEUS, 3D-printed rocket engine parts, Advanced propulsion technologies, Landing pad & plume technologies, Metal oxide warming systems, and Autonomous GNC software.

Masten Mission One

Powering a safe, precision landing at the Lunar South Pole

The diagram shows the trajectory of Masten Mission One, starting from Earth and ending at the Lunar South Pole. The steps are: 1. Launch, 2. Orbit Insertion, 3. Trans-lunar Injection, 4. Trajectory Correction Maneuvers, 5. Lunar Orbit Insertion, 6. Descent Orbit Insertion, 7. Braking/ Powered Descent Initiation, 8. Landing, 9. Payload Management & Deployment.

Masten's complete solutions and plans will propel the Lunar / Artemis missions.

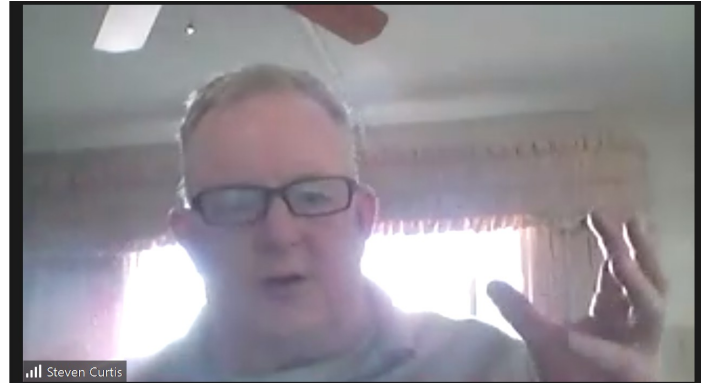
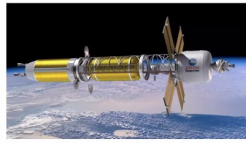
(Continued on the next page)

AIAA LA-LV New Space mini-Conference 2021 (2021 April 17)

(Continued from the previous page)

Future Space Power At Least 50 Years Away

- Fusion
 - Light materials
 - More power density than fission
- Space Based Solar
 - Large Orbiting Arrays
 - Transmit Power with Microwaves
 - China – Space Solar Power Station (OMEGA)
- Nuclear Rockets
 - Do not make sense for getting to space from earth (now)
 - Do make sense for long trips (like Mars)
 - Some research still going on
 - DRACO rocket – HALEU – Looks promising



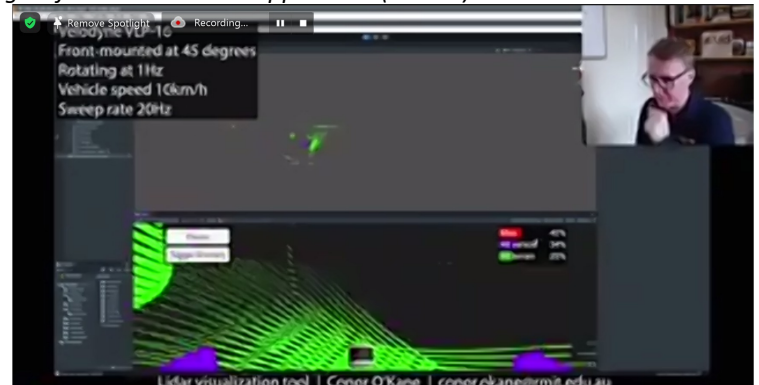
Mr. Steven Curtis discussing the future Space Power for at least 50 years away, very important for the safe and efficient solar system exploration and human settlement in Space.

Nuclear Engine for Rocket Vehicle Application (NERVA)

- 1960s
 - Research at the Nevada Test Site
 - Nuclear reactor engine
 - EMAD and RMAD facilities
- NERVA Rocket
 - Best for deep space
 - Less weight of fuel
 - Heats Hydrogen
 - More thrust per weight
- <https://www.youtube.com/watch?v=eDNX65d-FBY>



Mr. Curtis reviewing the history of Nuclear Engine for Rocket Vehicle Application (NERVA).



Mr. Conor O'Kane (Io Normal) demonstrating the Mars Flight VR he developed, which included the exciting and useful AI Terrain Recognition Training with Machine Learning.



Mr. O'Kane showing his other interests and efforts on Europa Flight VR, Mars Helicopter VR, Augmented Reality (AR) style HUD, and 3D printing HIRISE DTMs or 3D Printing in general.

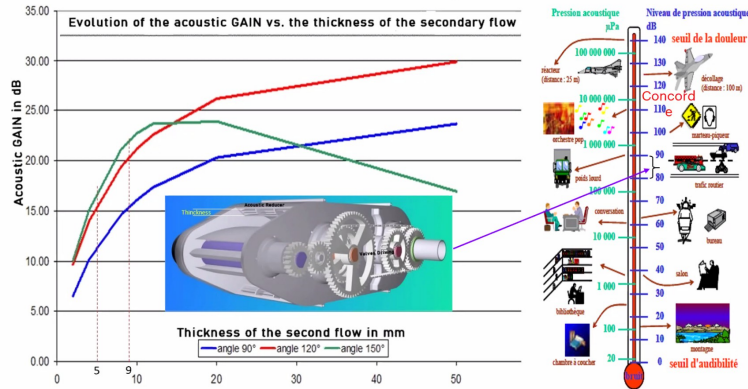
AIAA LA-LV Earth Day Celebration 2021 (2021 April 24)

- (1) "Taking off from your garden: It's possible!" by Mr. Jean-Philippe Régnault and Mr. Michel Aguilar
- (2) "Be Green, Keep flying" by Ms. Christine Lin and Mr. Chiu-Yüeh Blaise
- (3) "The Climate of the 21st Century from Space" by Dr. João Teixeira

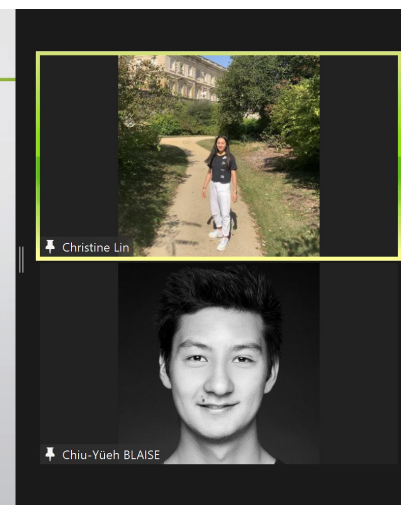
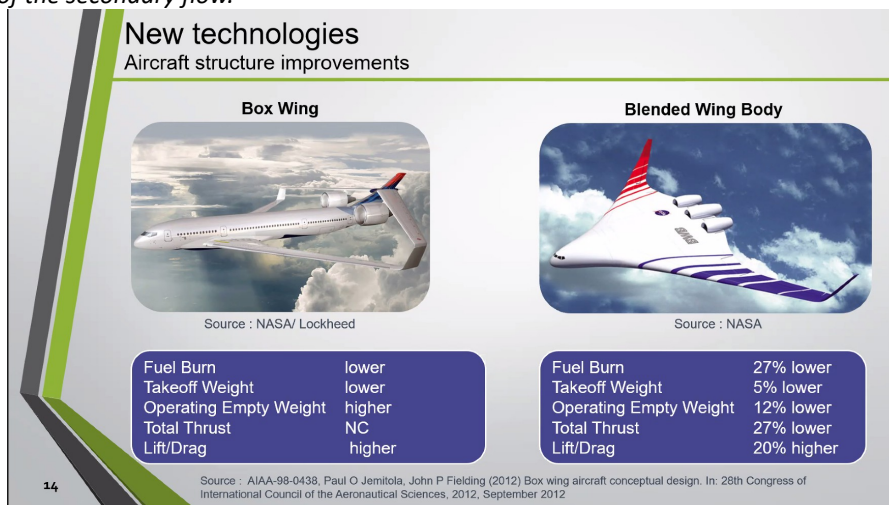
(Continued from Page 12)

WHAT HAS BEEN PERFORMED WITH THE FRENCH INDUSTRY & WW ECOSYSTEM UNTILL NOW (4/4)

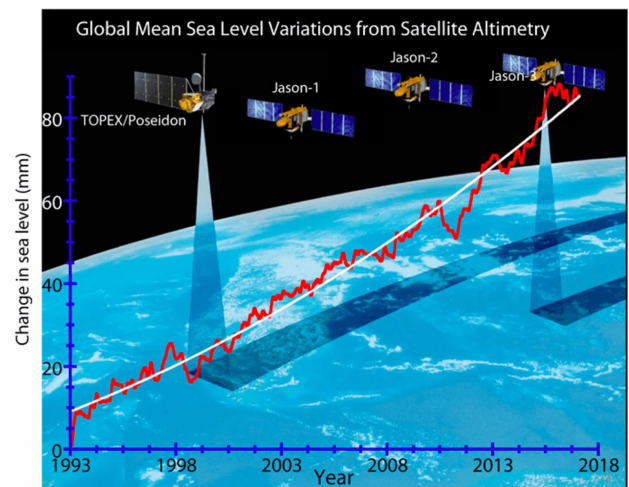
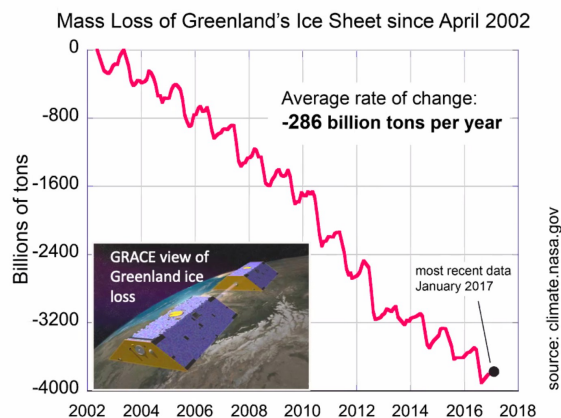
The noise concern and the solutions implemented



JP and Michel explaining the importance of noise reduction and the efforts in the French industries, and the effect of acoustic gain vs the thickness of the secondary flow.



Christine and Chiu-Yüeh mentioning that the aircraft structure improvements are also very important parts of the green aviation.



Dr. João Teixeira, using the public domain information, showing the GRACE studies on Greenland's Ice Sheet, and Jason's family/TOPEX/Poseidon studies on Global Mean Sea Level variations.

(Continued on the next page)

AIAA LA-LV Earth Day Celebration 2021 (2021 April 24)

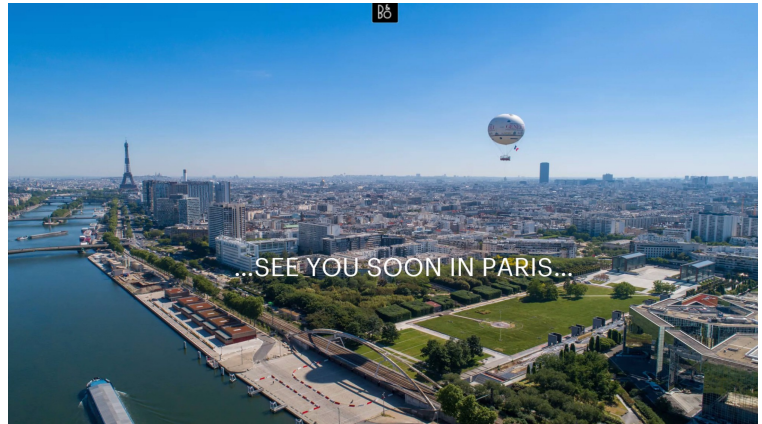
- (1) "Taking off from your garden: It's possible!" by Mr. Jean-Philippe Régnauld and Mr. Michel Aguilar
- (2) "Be Green, Keep flying" by Ms. Christine Lin and Mr. Chiu-Yüeh Blaise
- (3) "The Climate of the 21st Century from Space" by Dr. João Teixeira

(Continued from the previous page)

JEAN-PHILIPPE REGNAULD 'THE FAN MARKET MAKER' BIO



Beyond his activities in the world of digital and data transformation of large international companies as Managing Director of an American consulting company Jean-Philippe is vice-president of the Star's UP festival near Paris, France. This festival aims to bring together the general public and French and European experts, investors, and researchers in aeronautics, air ballooning and space to reflect on the future of air transport modes. This festival takes place this year at the end of June in Meudon near Paris in partnership with the Spaceconnect event and the future of the ballooning conference



JP mentioning an upcoming fun aeronautic show/festival in the beautiful city of Meudon, near Paris. And maybe some day in the future some of our AIAA / LA-LV members/attendees/audience could meet over there in Paris.

New technologies New propulsive energy

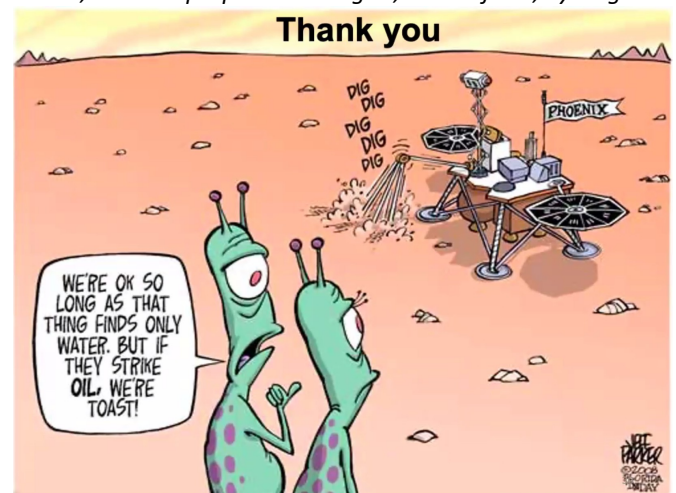
Source : LBST/BHL 2016

Christine Lin

Chiu-Yueh BLAISE

Christine and Chiu-Yüeh talking about another important factor in green aviation, the new propulsive energies, like biofuels, hydrogen etc.

June 1988 - a NASA scientist testifies to congress: global warming has begun...



Dr. João Teixeira showing a newspaper heading in 1988 to open the event (left), and a fun public art to end his insightful presentation (right).

AIAA LA-LV Award Announcement and Ingenuity Talk (2021 May 1)

(1) AIAA LA-LV Excellence Award 2021 Announcement, by Dr. Jeff Puschell (AIAA Fellow);

(2) Ingenuity Mars Helicopter: challenges, first flights and live Q&A with a member of the team, by Dr. Jeff Delaune

(Continued from Page 13)

AIAA LA-LV Excellence Award 2021

Ingenuity Mars Helicopter Team

represented and received by:

Ms. MiMi Aung

Ingenuity Mars Helicopter Project
Manager
NASA Jet Propulsion Laboratory

Mars 2020 / Perseverance Rover Team

represented by:

Mr. Aaron Stehura

(received by **Mr. Allen Chen**)
EDL Systems engineer at the
Jet Propulsion Laboratory

AIAA LA-LV Best Event 2021

Space Architecture Gathering

goes to:

Prof. Madhu Thangavelu

Faculty Member, USC / ISU

Award Announced and presented by

Dr. Jeff Puschell

Section Chair, AIAA LA-LV Section;
Fellow, AIAA

Principal Engineering Fellow
Chief Scientist, Space Systems
Raytheon Intelligence & Space
Raytheon Technologies Corporation

Dr. Jeff Delaune explaining the AI / Machine Learning used on Ingenuity for identifying possible targets of interests, answering/addressing a question from an attendee in the Q&A session, which included MiMi's and Aaron's comments, along with Dr. Puschell's remarks.

High school junior's consumer seismometer delivers low-cost earthquake early warning (Continued from Page 14)



Vivien He with her earthquake early warning devices to be deployed across Los Angeles. (Credit: Vivien He)

She began reading about earthquake early warning and building a giant three-ring binder of highlighted papers, including many from SSA journals. One of her favorite researchers in the field was Richard M. Allen, director of the Berkeley Seismology Lab.

"I really enjoyed the way he explained earthquake early warning systems and the current systems' limitations," He said.

The research gave He the confidence that she could build a low-cost device for earthquake early warning, taking a consumer-based approach versus the conventional public station-based approach. After that, it was time to figure out the components, the programming and the design. She didn't have much expertise going into the project, however, given much of the skills and knowledge needed were outside of school curriculum.

"I went to an MIT hackathon the other day, and what they said is that the secret for hackers is that they just google everything, right?" she said. "And that's kind of like what I did for this project, like, oh, I don't know how this works, just google it!"

As He will discuss in her SSA presentation, the device evolved over time as her skills improved and she solved design problems along the way. Along with its alert and notification functions, the final design contains a data card that can hold up to four years' worth of standard earthquake waveform files that can also be used for seismological studies.

"Hey, You Guys Hear That?"

He plugged in her first seismometer one night after midnight last September. "And then I went to sleep, and then the next day I woke up and there had been an earthquake in Los Angeles and I was like, oh, it's fate!"

She compared the seismic signal captured by her device to one produced by a U.S. Geological Survey station near her house, "and the waveform looked the same," she recalled.

One of the early successes of her testing period came when "my family was all in the living room and we were all talking and the device started beeping and I said, 'Hey, you guys hear that?' And they were like, 'is it an earthquake?' and then the pendant lights started shaking," she said.

The seismometer has since successfully detected several recent earthquakes in Southern California, and He has competed in science fairs at her school district and Los Angeles County. There, she won the International Science and Engineering Fair (ISEF) Finalist award, which moves her on to compete at the international level next. In addition, she won the Association of Women Geoscientists Award, the Cheryl Saban Self-Worth Foundation for Women & Girls 1st Place Award and Scholarship, and the Professional Engineers in California Government's Marilyn Jorgenson-Reece Award of Excellence and Scholarship.

He, who turned 17 in February, is working on getting a utility patent for the device. She plans to use her nonprofit to drive consumer adoption for the [device](#), especially making earthquake early warning accessible for the lower-income countries, regions and population.

"The whole point of it is that it would be a consumer product, but I'm not focused on the monetary gain of it," she explained. "I'm more focused on the science of it and just the impact in general on people and on earthquake disaster prevention."

Cancel the drag

(Continued from Page 15)

(End of Part II)

But, the colonel Lafay (France) conscious of the importance of this physical phenomenon, and noting that the speed in this beginning century became also a strong argument of the vehicles in all domains, decided to make an analysis more.... scientific. And here are his first conclusions:

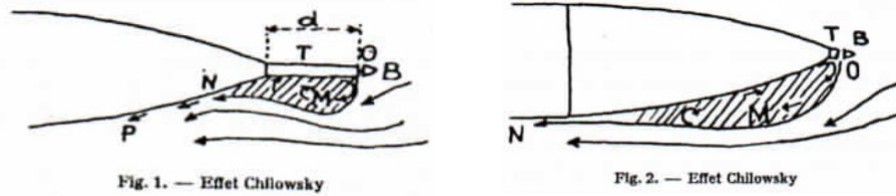


Fig. 3: Colonel Lafay Experiment (Credit M. A.)

« ... For a wind speed of 30 m/s, an acetylene blade characterized by a thickness of 0.3 mm, and finally an overpressure of 0.5 bar, M. Lafay obtained the following results grouped together, and for different values of d (mm):

- 35 mm, increase in resistance of 1/10;
- 15 mm, same effect, but the increase in thrust is smaller;
- > 5 mm, the effect decreases in intensity;
- 5 mm, obtaining a very clear propulsive action!
- < 5 mm, action increases in intensity! "

This physical effect, which took the name of its discoverer (of which Nature has not given us any example!), will henceforth be called the "Chilowsky effect".

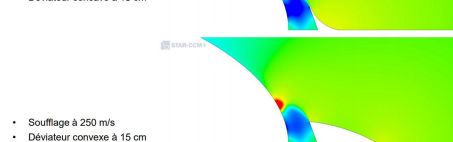
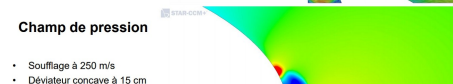
But surprisingly, this effect fell into oblivion in the world of aerodynamicists to finally reappear nearly 100 years later with the torpedoes experimented first by the Russians, then (once is not customary ...), by the Americans who have succeeded in crossing the hydrodynamic sound barrier, that is to say, nearly 1500 km / h under water!

In France, with funding from Mr. Laurent Tapie (son of the famous French businessman, Bernard Tapie), we have continued to explore this physical phenomenon, especially since more than 100 years after this discovery, we have "investigative tools" that enable us to verify all the possible advantages and the numerous applications at a lower cost. In this sense, we own a first patent issued by France, which we have extended to the United States.

Force exercée en X sur le profil		CFD-2D Chilowsky Effect	
SANS déviateur	Force de pression (N)	Force de Cisaillement (N)	Force Totale (N)
No Blowing	-97.0	-31.2	-128.2
Blowing 200 m/s	-4.1	-50.0	-54.1
Blowing 250 m/s	+43.0	-60.3	-17.3

DEVA, Concave 15 cm	Force de pression (N)	Force de Cisaillement (N)	Force Totale (N)
No Blowing	-103.0	-32.6	-135.6
Blowing 200 m/s	+11.7	-50.4	-38.7
Blowing 250 m/s	+64.4	-61.7	+2.7

DEVA, Convexe 15 cm	Force de pression (N)	Force de Cisaillement (N)	Force Totale (N)
No Blowing	-109.2	-32.2	-141.4
Blowing 200 m/s	+69.3	-60.4	+8.9
Blowing 250 m/s	+58.6	-60.3	-1.7



Here are some very brief results from numerical explorations (CFD) mentioned above that suggest that we should go much further, and thus identify the sensitivity of ALL the parameters that regulate this effect...

In the next part (Part II), we will detail an application (among many others) dedicated to the electric car which demonstrates the strong increase of the battery autonomy because of this aerodynamic effect without impact on the environment.

Of course, we will take particular attention to measure the power "injected" by the air compressor (but whose compression ratio will not exceed 1.5 and a flow rate lower than 1.5 kg/s depending on the dimensions of the blowing slot), and this same power used in direct thrust... (End of Part I)

(Continued on the next page)

Fig. 4: Chilowsky CFD (Credit: M.A.)

Cancel the drag

(Continued from the previous page)

(Beginning of Part II)

In this 2nd part on the Chilowsky effect, we will explain some results from numerical simulations, still in 2D, as well as from tests in a wind tunnel. We will then compare the energy used to produce air by the compressor, and this same energy used directly to produce thrust.

Explanations

This effect, not found in Nature, can be considered as a kind of corolla, an aerodynamic umbrella that prevents the air molecules from impacting the solid surfaces of the front part of the moving vehicle, and thus reduces the famous drag or force that is opposing the movement. How does it work?

Considering the problem solved, that is : the right thickness of the blowing slot, the right ejection speed of the blowing air, the right blowing angle, the right distance of this blowing slot to the front part, the right volume of the blowing cavity, and the right shape of the front tip of the blowing device, In other words, the best parameters of this device for a maximum reduction of this drag, it occurs that in this cavity, a depression appears as a result of the entrainment of the air molecules which resided there by viscosity effect activated by the blowing (Fig. 1).

An illustration "is better than a thousand words" as Napoleon Bonaparte liked to say:

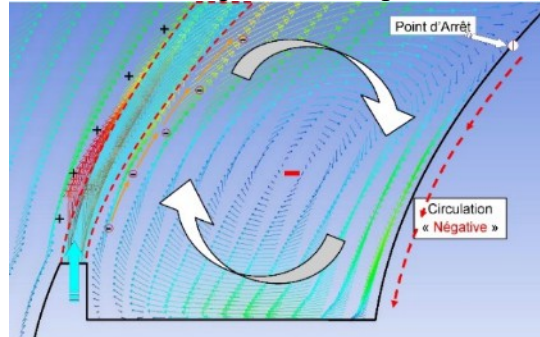


Fig. 1: Central Paris CFD 1/2Credit: M. A.

On this illustration it appears that a depression develops in the blind cavity (because framed by plates), and it is precisely this depression which produces a thrust which comes to be subtracted - even, which can become propulsive, and which one would call, by abuse of language, a negative drag -, to be thus subtracted from the drag of the vehicle.

"Providence" put on my path some 1st year students (just out of their second order differential equations with variable coefficients!) of one of the greatest French engineering schools, the École des Mines ParisTech. This was at the request of the famous Sophia Antipolis research Center located on the hills above Nice. Several groups were formed, one of which was to explore - at least numerically - the Chilowsky effect (Fig. 2 & 3). And, of course, under the permanent control of Elie Hachem (taught at Stanford). Here are some results made on a "vehicle" of elliptical shape, and from the reference data below:

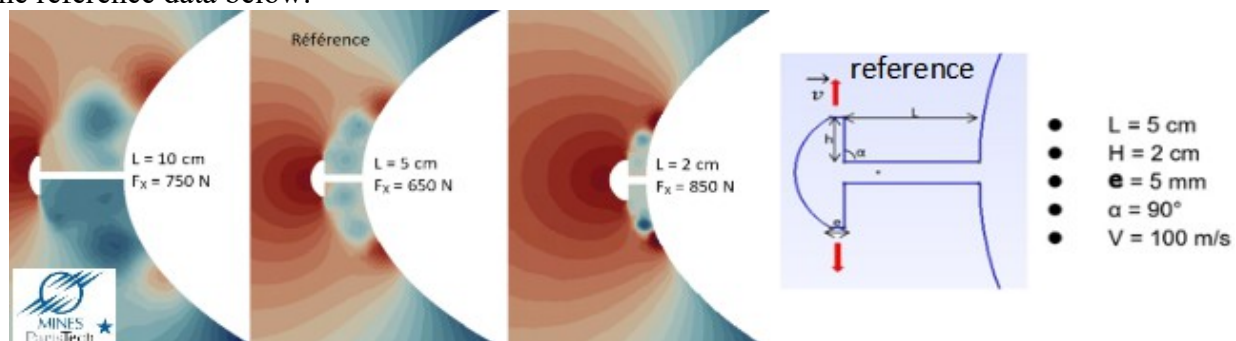


Fig. 2: Mines ParisTech 1/2Credit M. A.

(Continued on the next page)

Cancel the drag

(Continued from the previous page)

(Part II)

In this first investigation, the distance L of the vehicle span was varied by 1 meter. From the reference data, there is a length L that minimizes drag. Indeed, with these 3 points of "measurements" of the drag vs the distance L , we can then advance that the distance L which optimizes the minimal drag has for value: $L = 6,575$ cm and drag $FD = 624$ N.

There is indeed a reduction of the drag due to this Chilowsky device!

Another important parameter is the blowing speed, which simulations indicate:

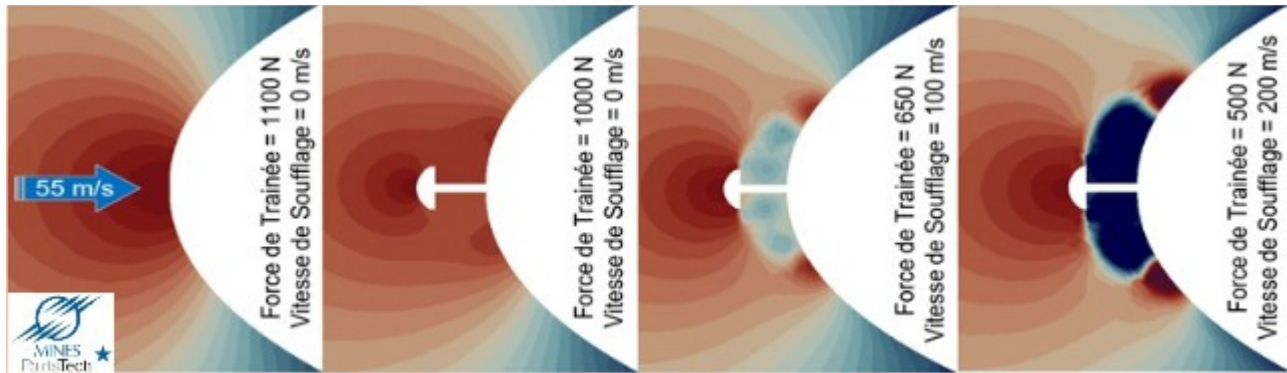


Fig. 3: Mines ParisTech 2/2Credit M. A.

Thus, a compression ratio of the air of 1.5 allows, ideally (without pressure losses) to obtain blowing speeds of approximately $V_{\text{Blowing}} = 266$ m/s and a flow rate Air flow = 1.96 kg/s, and the slot dimensions: $e = 3$ mm and span = 100 cm for a power of the compressor with an efficiency of 0.85, and a mechanical efficiency of 0.9 $\Rightarrow W = 90$ kW

But an important question remains: What if, with the same energy used by the air compressor (compression ratio < 1.5) to produce the air flow and the ejection speed of this Chilowsky device, we used this same energy to produce a direct thrust?

The input data are as follows:

- 1) Travelling speed = 200 km/h (55.5 m/s)
- 2) Drag without device, and therefore without blowing: 1100 N (numerical calculation)

Hence:

- a) Direct Thrust: $T_{\text{Direct}} = \text{Flow rate (2 slots)} \times \text{blowing velocity (continuous)} = 2 \cdot \gamma \cdot Pa \cdot S_{\text{slot}} \cdot M^2$
- b) Pa = Atmospheric pressure = 101325 Pascal, M = Mach (100/340) and a = ground speed of sound = 340 m/s
- c) Thrust Direct: $T_{\text{Direct}} = 123$ N, thus a direct resultant drag = $1100 - 123 = 977$ N
- d) Thrust Chilowsky = 624 N (optimized)
- e) Drag gain: $T_{\text{Direct}} - T_{\text{Chilowsky}} = 977 - 624 = 353$ N, that is to say a gain of $(353/977) = 36\%$!

But it is possible to do much better by combining the Chilowsky and Coanda effects. But obviously, the "Direct" and "Blowing" curves will cross each other!

In addition, wind tunnel tests were realized by another prestigious French engineering school, the École Centrale Paris, where a blowing on the leading edge of the profile with its lateral plates in transparent plastic appears (Fig. 4):

(Continued on the next page)

Cancel the drag

(Continued from the previous page)

(End of Part II)

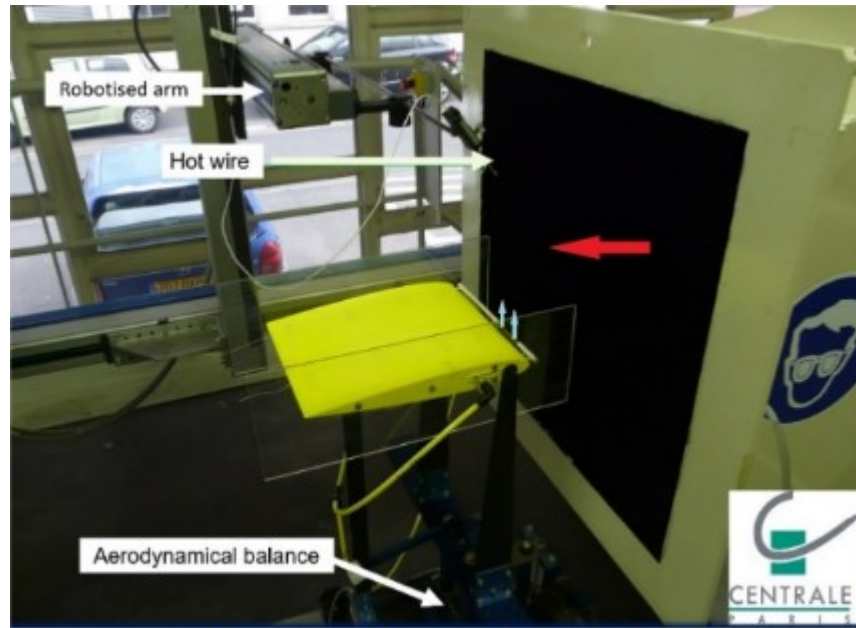


Fig. 4: Central Paris 2/2Credit M. A.

In the 3rd part, we will implement this Chilowsky device on the electric car, since by technological construction, an electric car does not require a radiator positioned on the front part of the vehicle (for cooling), which makes it possible to optimize the design of this device, whether it is retractable or not, pulsed blowing or not. We will see that a single blowing slot is enough (extrados to press the car on the road), and a blowing angle of 20° increases the propulsion force for lower blowing speed, and a compressor power < 30 kW.

It is then possible to introduce a new aerodynamic coefficient such as after the C_D (drag), the C_L (lift), the C_M (pitching), it would come the C_{Ch} or C_Y (Chilowsky).

(Continued on the next page)

Cancel the drag

(Continued from the previous page)

(Beginning of Part III - Applications)

After the history of the inventor of this drag reducer developed by Pr Constantin Chilowsky in part I, after the scientific explanation of this effect from now on called "Chilowsky effect" and the various parameters which condition this effect in part II, it remains us to mention some applications of this incredible effect!

Aeronautical application

There is no longer any doubt that reducing aerodynamic drag is a major factor in reducing fuel consumption, and as an immediate corollary, reducing drag also means reducing the impact on the environment, whether chemical or acoustic. Our medium to long term objective is to produce a drone that would integrate ALL the innovations, and to make it known to the whole world, in particular thanks to the Paris Air Show of 202X! Moreover, in order to reduce consumption even more, and as soon as the environment allows it, this drone will be WIG compatible (Wing In Ground effect) by using the seas or even the highways whose surface is perfect.

Here is what this drone could look like. Figure 1 shows it taking off (VTOL), and, in the center, cruising on a dedicated highway:

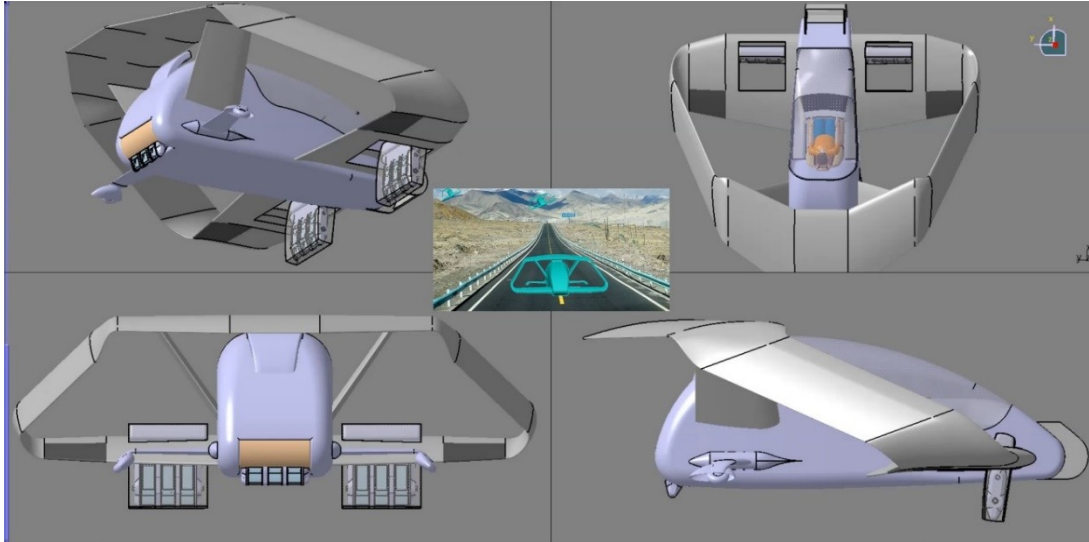


Fig. 2: Drone WIG (Credit M.A.)

A clarification on the WIG character of this aircraft: It is this effect observed by all the pilots in phase of landing on the runway whereas the pilot has the stick to prick, the aircraft "refuses" to go down to put the wheels! It is a sort of air pillow that is interposed between the wings (low wings) and the runway, thus producing additional lift.

The following curve (figure 2) which shows the lift coefficient (CL) as a function of the angle of incidence, i , of the wing explains the gains in fuel consumption in the WIG phase.

Indeed, this air bag which is interposed between the runway, and more generally between a flat surface (sea or road), and the wings creates an additional lift. In fact, to keep the same lift in the WIG effect, the angle of incidence, i , of the wings must be reduced, which will reduce the drag, and therefore the fuel consumption.

(Continued on the next page)

Cancel the drag

(Continued from the previous page)

(Part III - Applications)

Several tests conducted in the United States, but also in Germany and Japan (the Russians were the pioneers in this field), show that it is possible to reduce consumption by nearly 40%.

Migratory birds can testify to this!

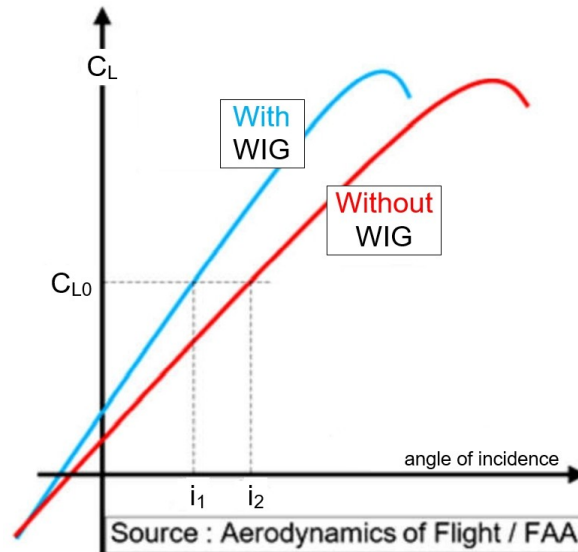


Fig. 2: WIG or not WIG (Credit M.A.)

Terrestrial application

We have seen that the Chilowsky device can be applied to any vehicle moving with a significant speed in the atmosphere. This device reduces, even cancels, and can even reverse the drag force. In fact, applied to rolling vehicles such as cars, trucks, or even trains, it can contribute to a strong reduction of the impact on the environment, considering that currently more than one billion thermal engines heat and chemically pollute the planet.

Cars and Trucks: The Equation to Solve

The forces that are opposing the advancement of the cars are the following:



Fig.3 : Forces oppositions (Credit M.A.)

With F_R = Rolling Resistance, and F_A = Aerodynamic Resistance

The expressions accepted by all manufacturers are written:

$$F_R = 0.1.M.(1 + V/41) \text{ and } F_A = 1/2.\rho.(S.C_D).V^2$$

(Continued on the next page)

Cancel the drag

(Continued from the previous page)

(Part III - Applications)

V (m/s) = vehicle speed and M (kg) = vehicle mass

Speed limits on US roads and highways (Fig. 4):



Fig. 4: Speed limits (Credit M.A.)

We will take as limit speed: $V = 33$ m/s (120 km/h / 75 mph).



Fig. 5: SC_D (Credit M.A.)

It remains for us to consider the "famous" SC_D (Drag) whose following references (Fig. 5) will help us to determine the undeniable advantages of the Chilowsky device:

Considering a number of cars, we will have an average $SC_D = 0.65$ as shown in this table (Fig. 6):

Uno : 0.60	Scirocco : 0.66
Super5 : 0.63	928S : 0.74
Panda (ancienne) : 0.68	Carrera 2 (964?) : 0.68
Cox : 0.86	BMW 318i : 0.73
2CV : 0.84	911 GT2 (462ch) : 0.67
Kadett GSi : 0.57	575 M : 0.594
Alfa Romeo 33 : 0.67	Murciélago : 0.66
BX : 0.65	RUF R Turbo (520ch) : 0.67
R25 : 0.61	Edonis : 0.609
Volvo 760 : 0.86	Citroen C4 : 0.62
Granada : 0.94	Peugeot 307 : 0.72
RX-7 : 0.61	Peugeot 407 : 0.64
Fuego : 0.62	Renault Laguna : 0.62
Average $SC_x = 0.65$	

Fig. 6: Average SC_x (Credit M.A.)

(Continued on the next page)

Cancel the drag

(Continued from the previous page)

(End of Part III - Applications)

Examples

The input data are: $V = 33 \text{ m/s}$, $M = 1200 \text{ kg}$ and $SC_D = 0.65$ with the expressions used above determining the opposite forces:

$$F_R = 0.1.M.(1 + V/41) \text{ \& } F_A = 1/2.\rho.(S.C_D).V^2$$

$$F_{\text{Total}} = 216.6 (F_R) + 424.7 (F_A) = 641.3 \text{ N}$$

Some possible solutions

1) On the mass M : It is possible to lighten the mass of the vehicle in an aerodynamic way by giving a wing shape to the vehicle, which will have the effect of reducing this mass on the road by the lift thus created.

2) Chilowsky device: This one can only interfere on the aerodynamic aspect; in fact, with a low power air compressor, and a blowing slot whose span will not exceed 1 meter, the Chilowsky coefficient (C_Y) will oscillate between:

$$0.2 < C_Y < 0.5$$

In these conditions the F_A remains between: $84.9 \text{ N} < F_A < 212.4 \text{ N}$

And thus a total opposed force (keeping a total mass of the vehicle of 1200 kg):

$$301.5 \text{ N} < F_{\text{Total}} < 429 \text{ N}$$

So, a gain G :

$$33\% < G < 53\%.$$

In Europe, the liter of gasoline 98 is about 1.8 \$ (1.5 €), and if one admits that an average vehicle consumes, on highway at 120 km/h, about 10 liters /100 km, then on a journey of 1000 km, this motorist will have consumed 100 liters. And thus, according to the "Chilowsky Gains" he will save:

$$59.4 \$ [0.33 \times (100 \times 1.8)] < G_{\text{Chilowsky}} < 95.4 \$ [0.53 \times (100 \times 1.8)]$$

This is for a single trip in the year!

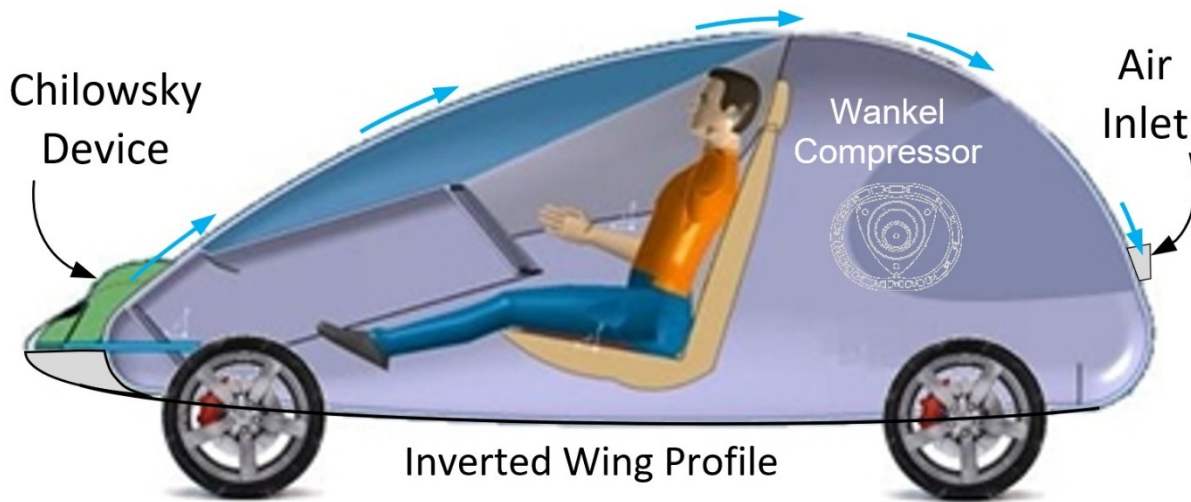
And if we go to a maximum speed of 85 mph (38 m/s), the gains are more important, because the aerodynamic effect takes "all the space":

$$64.8 \$ [0.36 \times (100 \times 1.8)] < G_{\text{Chilowsky}} < 104.4 \$ [0.58 \times (100 \times 1.8)]$$

With the aerodynamic thrust due to the inclination of the air slot, and even the aerodynamic reduction (16%) of the car's mass:

$$100.8 \$ [46\% \times (100 \times 1.8)] < G_{\text{Chilowsky}} < 122.4 \$ [68\% \times (100 \times 1.8)]$$

Chilowsky Car?



What about trucks with an $SC_D > 3$?

A Cloud Black Box That Gentlemen Do Not

(Continued from Page 16)

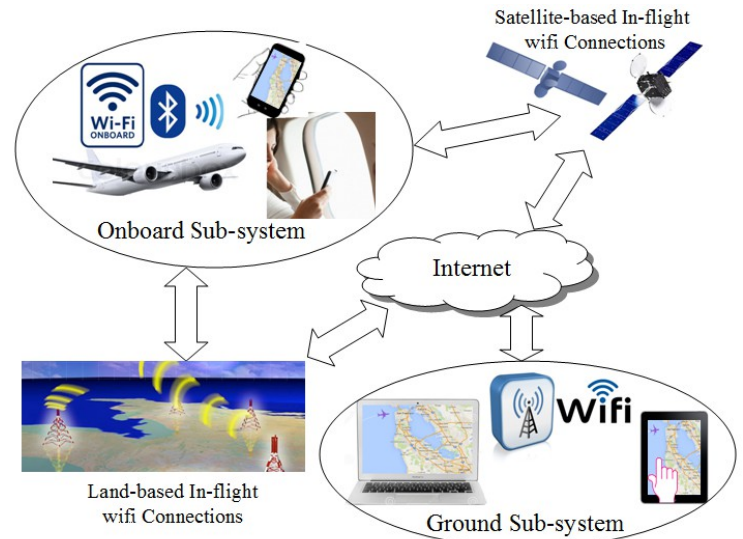
At that time, former Space spy astronaut General James A. Abrahamson ran the Strategic Defense Initiative (SDI) also known as "Star Wars" during Reagan administration. After retiring from the Air Force, Gen. Abrahamson coordinated an air traffic and safety initiative, served as an advisor to FAA's NextGen and other Civil Aviation Authorities. He is very low-key, like a professor rather than a military leader.

It was proposed and considered that the flight data/voice recorder should be online, that is the black box should not be tied to an aircraft only. ADS-B could be augmented to cover the vast (greater than 90%) oceanic aerospace that was the "blind spots" of radars. The concept behind this vision of air safety decades ago is what we now call the "Cloud".

After the crash of Air France Flight 447 into sea in 2009, ACARS (Aircraft Communications Addressing and Reporting System), a digital data link system for short message transmission between an aircraft and the ground stations via radio or INMARSAT satellites, provided the first clues of what might have gone wrong. However, the investigation was hampered because the aircraft's black boxes were not recovered from the ocean floor until May 2011, nearly two years later. There were serious discussions about making ACARS an "online black box" afterwards to mitigate the adverse effects of losing a flight recorder. However no improvement was attempted in the industry due to the costs of implementing the proposal.

In March 2014, right after the disappearance of Malaysia Airlines Flight 370, there was a great confusion of where the airliner went down. ACARS hand-shake messages and Doppler analysis of INMARSAT satellite data played a vital role in finding out a much unexpected scenario. While the primary ACARS system on board MH370 had been turned off, a second ACARS system was active as long as the plane was powered up, and kept trying to establish a hand-shake connection to an Inmarsat satellite every hour. MH370 is still missing and the investigation is also hampered. What if the airlines had real-time Internet-based flight data, voice/video and position recorders? The aircraft may not be missing for so long, and a tragedy such as Air France 447 might have even been diverted in the first place.

We shall discuss the concepts and operational aspects of a Smartphone or PC-based Automatic Dependent Spying (ADS) app TrackView, flight data display apps and the results of the flight tests. The solution is low cost, can be autonomous or manually controlled. It is not interfering with today's flight operations.



The TrackView system components (Credit: the author)

Proof of Concept flight tests results:

1. Tracking and Viewing using General Aviation Aircraft

The aircraft used for these tests were Collings Foundation WW2 B-25 Mitchell and B-17 Flying Fortress bombers. We flew twice on the B-25 with Hedy Lamarr (an inventor of the spread spectrum communication) as the nose art. One trip was from the NASA/Moffett Field in Mountain View, Calif. along San Francisco Bay, and then turned around at Treasure Island. The other trip was to the west with no obvious landmark.



Hedy Lamarr

Frequency Hopping Communication System

US Patent No. 2,292,387

Inducted in 2014

Born November 9, 1914 - Died January 19, 2000

Actress Hedy Lamarr was best known for her work in Hollywood during its Golden Age, starring in films such as Ziegfeld Girl and Samson and Delilah. But Lamarr also worked with Hollywood composer George Antheil to invent a frequency hopping technique that today is referenced as an important development in the field of wireless communications.

Believe it or not, she co-invented the communication technology behind GPS and wireless phones we are using everyday now. (Source: National Inventors Hall of Fame) (Continued on the next page)

A Cloud Black Box That Gentlemen Do Not

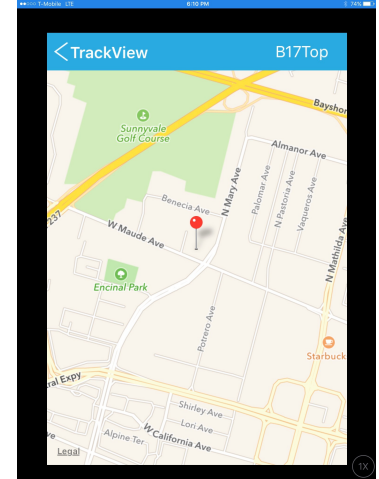
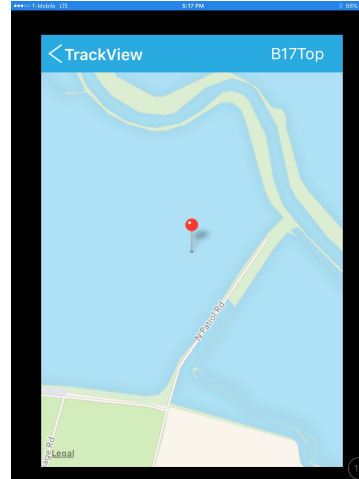
(Continued from the previous page)



The B-25 over Treasure Island was tracked and viewed by the ground station. (Credit: B-25 from Collings Foundation, Treasure Island by Jerry Huang)



McCauley and the B-17 Nine-O-Nine (Source: Collings Foundation)
In all these test runs, T-mobile was the smart phone carrier to provide data link. A Google Nexus 5 was the airborne device; an iPad was at the ground station. Thanks to Captain McCauley, two autonomous airborne Smart phones were installed onboard the Nine-O-Nine B-17. One was in the bombardier's nose cone and the other at the navigator's bubble on top.



B-17 over the Bay Area was tracked (Credit/Source: the author)

Test Results:

The aircraft would lost contact with ground stations if over 1,000 ft. most likely due to the phone company's coverage limit in the Bay Area. As of today, Internet accesses are provided only by phone or cable companies. In the foreseeable future, regional or global Internet access will be available, such as Starlink provided by Low Earth Orbit (LEO) satellites.

A sad note: Collings Foundation B-17 Nine O Nine crashed in 2019. Capt. McCauley was killed in the accident. The annual Wings of Freedom tours around the country were suspended because of it and the pandemic.

2. Tracking and Viewing Commercial Flights

The configurations for this the real-time, online ADS systems tracking commercial flights are as the following diagram:



The passenger is using in-flight wi-fi services (Credit: the author)



(Continued on the next page)

A Cloud Black Box That Gentlemen Do Not

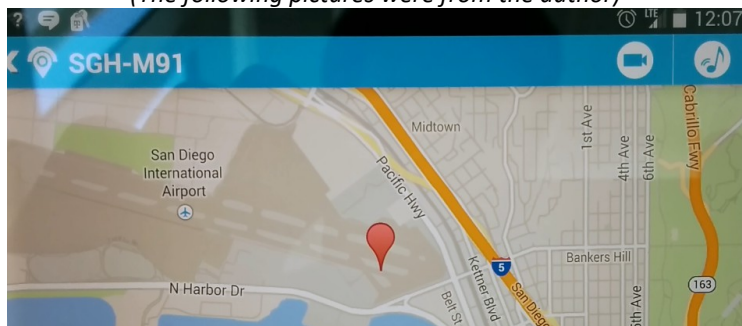
(Continued from the previous page)

All parties need to log in to the multi-platform or platform-agnostic tracking and viewing apps. The ground stations, using smart tablets or PC's, collect voice/video on board and track the flight path of the airliner.

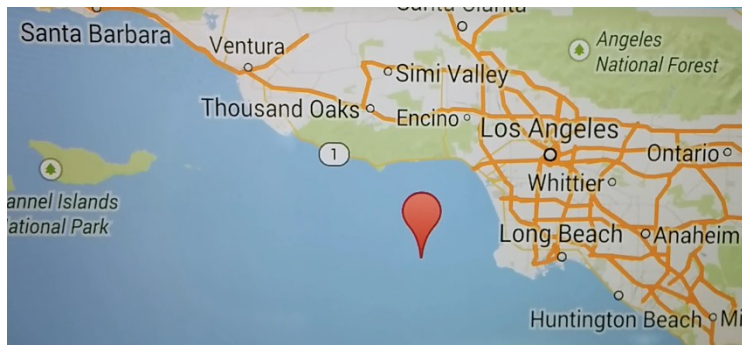
Domestic flight tests:

One of the domestic flights was on Southwest Flight 2397 from San Diego to San Jose, California. Southwest Airlines uses a KU-band satellite connection for the on-board wi-fi. The images were recorded real-time at the destination San Jose Airport SJC.

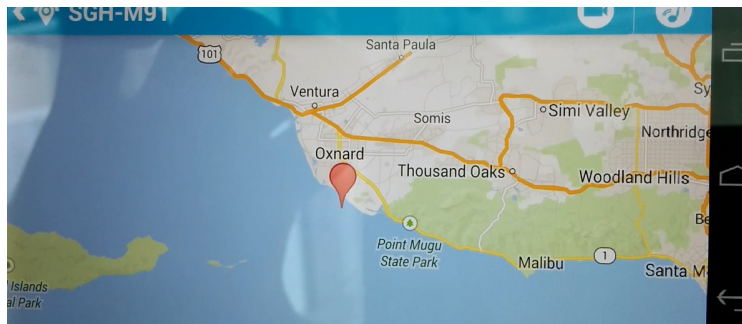
(The following pictures were from the author)



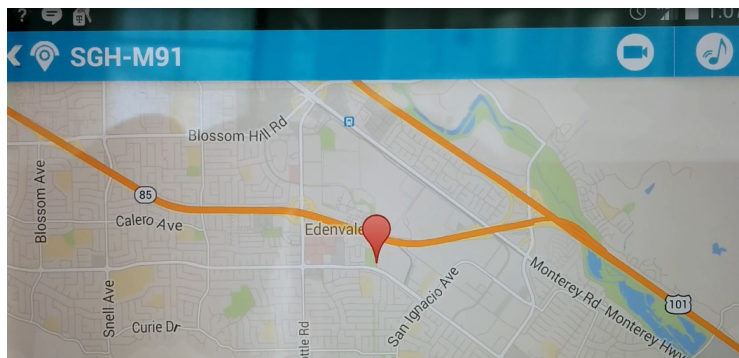
The flight is taxiing from a terminal to the end of runway



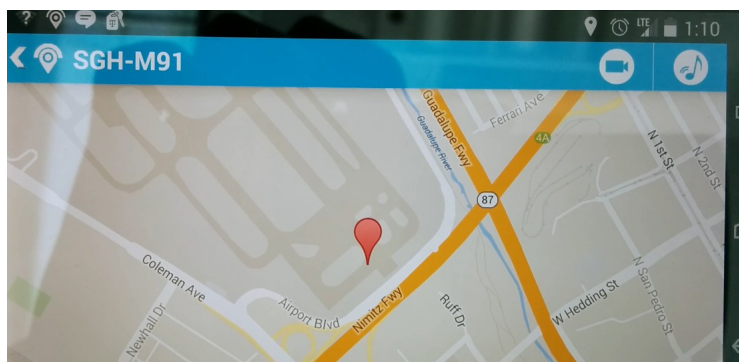
The flight is over the ocean for 25 minutes after taking off from San Diego Airport.



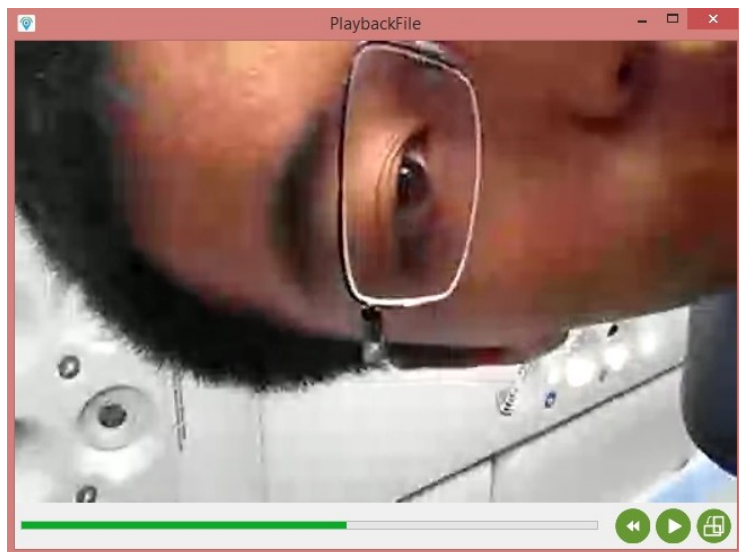
The flight approaches land near Oxnard



The flight approaches San Jose from the South.



The flight arrives at San Jose Airport. During the flight tests, the airborne device reported positions back to ground stations every five seconds excluding wi-fi blackouts while taking off and landing.



Playback of the recorded video and voice on board the flight. Some public wi-fi and hotspots, including the on-board wi-fi, do not allow video streaming. This clear video was processed very successfully, and got around with the limited bandwidth. It was viewed, recorded by the ground station in real-time. (Credit/Source: Shawn L. Huang)

(Continued on the next page)

A Cloud Black Box That Gentlemen Do Not

(Continued from the previous page)

Oceanic Flight Tests:

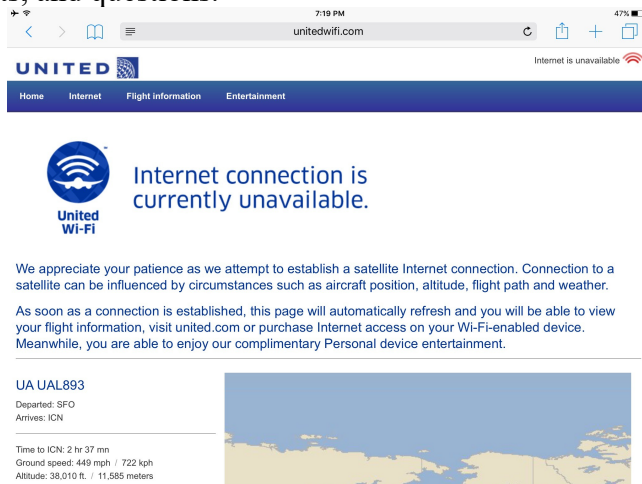
The following images were captured during the oceanic flights (United UAL893 from San Francisco SFO to Inchon, South Korea, and China Airlines CI003 from SFO to Taipei TPE/Taiwan).

Night vision is achieved by software digital signal processing; therefore no extra hardware is needed for the system. It is not supposed to work in pitch black. However, any dim light, for example, a reading light in the cabin, the flash light built-in with the smart phones would be good enough in resolving the contours of the objects in view. This feature could have been used to see what was happening in the passenger cabin of the MH370.



The video/voice on board while over the ocean, as recorded by a ground station during the flight in real-time. The video could be of great help to solve the mystery in aviation. (Credit: the author)

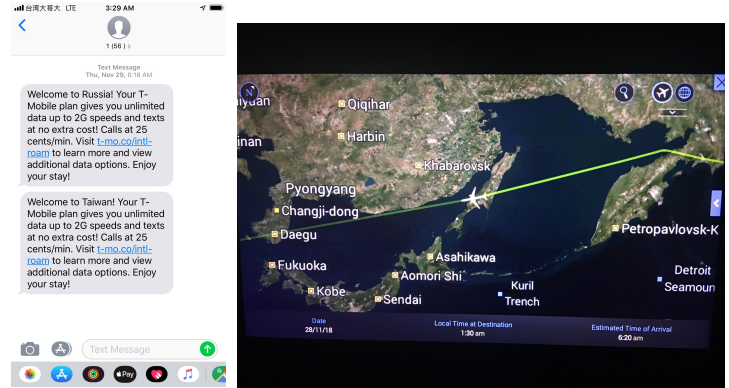
After these oceanic flight tests, we found interesting facts, and questions.



(Credit: the author)

In-Flight or Onboard WiFi Internet access is through the satellites and will not be available above certain latitude. The disconnection time is depending on the routes and the season because the communication satellites, INMARSAT for example, are geosynchronous and over the equator.

(Credit: the author)



A surprise was found during the other flight over the same vicinity when the WiFi onboard was out. While over Siberia and Sakhalin Island more than thirty thousand feet above, the cell phone received data message from the ground cell stations welcoming us to Russia. Our cell phone carrier was again T-Mobile; they are providing data plans in other countries around the world for the travelers. This is to say that our TrackView parties could see us at the comfort of home, just like tracking and viewing the B-17 and B-25 over the Bay Area. But the wireless data link was lost only over 1,000 ft. above there! There is a theory for that, but we have no way of proving it. What are your answers? Your ideas and feedback are needed. Please let us know at info@GentlemenDoNot.com thanks!

Readers are encouraged to repeat the tests during your next air travel for entertainment or curiosity. GPS signal reception is the tricky part on board an airliner. Seats next to the windows work fairly well because of the line-of-sight requirement to the GPS satellites. A decent GPS signal repeater would be needed for other seats in a typical passenger cabin. Using a window seat for the GPS signals would still experience an interrupt if the airplane making a turn more than 45 degrees or more because the sky view would be different. A GPS "Cold Start" might take longer than you think. Set your smart devices correctly, and be patient to wait for the GPS to work. The windows on a Boeing 787 with an opaque material might block GPS signals. Oceanic flight tests

(Continued on the next page)

A Cloud Black Box That Gentlemen Do Not

(Continued from the previous page)

were conducted on flights departing from SFO, OAK and LAX airports. The online voice/videos in the passenger cabin worked very good. The locations of the flights were available sporadically. The identified causes were the qualities of GPS signals and the availability of WiFi. Have fun!

Safety applications in daily life

Consumer Reports indicated that anyone could forget babies in car. Forgetting children is a common human error that can lead to tragic consequences. These Cloud cameras for home and car security can be installed easily the same way as mentioned above for your peace of minds.

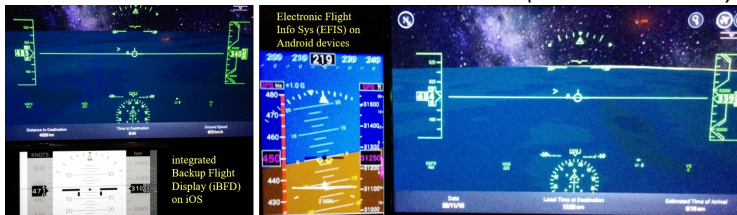
This is what we do so that “Sheep May Safely Graze!”

This is not us, we don't do [Phone spying](https://youtu.be/XWntoHuxXe8). (Video at <https://youtu.be/XWntoHuxXe8>)

Conclusion

A proof-of-concept online black box kit was built with the existing smart device based flight instrument display apps as the diagrams. It was used onboard the oceanic flight (CI003 from SFO to TPE) with the video functions. The first one is iOS-based; the second is Android-based.

(Credit: the author)



Flight attitude indicators and other flight data on the two smart devices are compared with the actual flight data displays of the aircraft Boeing 777. They are consistent. Since there is no Pitot tube air speed to the smart devices, the app displays showed the GPS ground speeds. The differences between ground speeds and the air speed of the aircraft are caused by the Jet Stream.

The satellite Internet access by Starlink or OneWeb and the 5G video quality should make the Cloud black box more practical. In fact, some pilot errors should be able to be corrected in time to prevent an accident. An online flight data/voice recorder or Black Box could make it possible to prevent mishaps from happening in the first place and shorten the amount of time require for investigations after a crash.

For the same reason, you can install a Cloud dash cam for your teenage drivers. But our teenagers weren't impressed by that at all after they were informed.

A Short Bio:

Jerry J. Huang is an aviation enthusiast and a retired researcher in air safety for CAA in Taiwan, Republic of China. He studied GPS and ADS-B since the 1990s shortly after they were made available to the civilian use. He performed flight tests on commercial airline flights and the Collings Foundation's World War II vintage bombers B-17 and B-25. He is the author of “GPS Puzzles and the Sherlock Holmes Mystery” and “Newton's Cannon Ball, Hawking's Floating Apple” with the pseudonym Jets Hunt. He can be reached at info@GentlemenDoNot.com

The case for restoring US nukes in East Asia

(Continued from Page 17)

The US Air Force had a considerable selection of bombers, including the B-29 that was used in the Hiroshima and Nagasaki atomic bombings, the B-36 Peacemaker, the B-47 Stratojet and the B-50 Superfortress.

The MK-6 (or Mark VI) was manufactured in large numbers between 1951 and 1955 and remained in service until 1962. It weighed about 3,629 kilograms (8,000 lbs) and was based on the plutonium fission bomb that was dropped on Nagasaki.

The typical yield of the bomb was 26 kilotons –but versions of the MK-6 ranged up to 160 kilotons. (By comparison, the Nagasaki “Fat Man” bomb had a kiloton range of 18 to 23).

When Eisenhower was told that the Air Force had readied a second strike by putting [B-47 nuclear bombers](#) on alert at Anderson Air Force Base on Guam, Eisenhower understood that even a first strike of 10 to 15 atomic weapons might not stop the Chinese. He looked for an alternative and chose negotiations to defuse the situation.

The US not only had gravity bombs in its arsenal. Among the many types of tactical nuclear weapons were cruise missiles and ground to air/surface to surface rockets. Among the former was the [MGM Matador](#), a jet-powered cruise missile with a range of 250 miles that was later extended.

It carried a [W-5 atomic warhead](#), the predecessor of the MK-6 with about the same yield profile. The [Nike Hercules](#) was a two-stage weapon primarily designed as a ground-to-air weapon intended to kill Soviet bombers. It was typically fitted with a low-yield nuclear warhead.

However, the Nike Hercules could also serve as a surface to surface theater nuclear weapon with a range of 90 miles (140 kilometers). In a surface-to-surface configuration, the Nike Hercules could carry a 28 kiloton atomic weapon.

While the US fielded a huge arsenal of nuclear weapons in both the Asian and NATO theaters, the US approach was different in Europe and Asia. In Europe, the US was

willing to enter into nuclear sharing and tasking agreements through NATO with Germany, the UK, Italy and Turkey, meaning that the European partner countries would be tasked to deliver US nuclear weapons on targets in case of a major Warsaw Pact attack.



*The Nike Hercules was originally designed to kill Soviet bombers.
Image: Wikipedia*

The sharing arrangement extended, in the case of the UK, to ballistic missile attack submarines, but not until 1981 when the [Trident program](#) got US approval. Otherwise, the US consistently opposed “local” or independent development of nuclear weapons in Europe, thwarting efforts by Italy and Germany.

In Asia, the US worked to kill nuclear weapons programs in South Korea and Taiwan. In the Korean case, this included blocking suppliers from Canada, France and Germany. It also included shutting down South Korean access to Nike Hercules technology, which the South Koreans wanted as a delivery system by extending the missile range.

The case of Japan was and remains rather more complicated because Japan developed both a significant nuclear power industry producing large amounts of plutonium and a [space program with long range rockets](#).

(Continued on the next page)

The case for restoring US nukes in East Asia

(Continued from the previous page)

However, while there have been from time to time voices in Japan suggesting the time had come for Japan to manufacture and deploy nuclear weapons, this has not happened. As a victim of US atomic weapons, Japan has a strong bias against nuclear weapons.

The US kept its nuclear weapons in South Korea for 33 years (1958 to 1991). On Okinawa, the US stationed nuclear weapons between 1957 and 1967 (and perhaps earlier). When Okinawa was returned to Japanese control in 1972, the US removed all its nuclear weapons. In the same year, the US removed some 200 US nuclear weapons from Taiwan.

The situation in Guam is more cloudy. Guam has gone through a transition where it no longer hosts strategic bombers full time — instead, it gets rotations of strategic bombers coming from the US (CONUS).

The US has three strategic bombing systems — the venerable B-52, the B-1 “bone” and the B-2 stealth bomber. The B-1 is no longer certified for nuclear weapons. Gravity nuclear bombs have also been removed from the B-52, leaving only the B-2 stealth bomber as a platform for nuclear weapon delivery.

The US Air Force is developing a [Long-Range Standoff Weapon](#) (LRSO) for the B-52, but the LRSO won’t enter service until 2030, if the program is continued. While the US is well along on developing a new strategic bomber, the [B-21](#), it won’t enter service until 2026-27 at the earliest.

The F-15 and F-16 have been certified to carry nuclear gravity bombs, but the US is converting to the [B-61-12](#) gravity bomb that so far has only been certified on the [F-15E](#). The F-35 stealth jet is not yet certified and may never be authorized for a nuclear mission.

In a nutshell, the US’ nuclear tactical capability has been significantly downsized or nearly eliminated, even while China has built a significant arsenal of missiles and aircraft that can deliver nuclear weapons.

In NATO, this has meant that some nations, Germany and Turkey in particular, no longer fly nuclear-capable fighter aircraft. And it has created peculiar situations such as the US base at [Incirlik, Turkey](#) that stores (now mostly obsolete) B-61 gravity bombs. There are no nuclear-certified US aircraft that operate at the base.

In the Northern and Eastern Pacific, the US does not have any tactical nuclear capability. Even in Guam there are no aircraft that could be launched to hit targets in North Korea or China using nuclear weapons.

The key question is whether the US virtual elimination of tactical nuclear weapons in North and East Asia is a good thing considering [China’s military buildup and nuclear attack capability](#) as well as North Korea’s [expanding nuclear arsenal](#).

The US plays the role of supporting its allies and friends and resisting aggression in the region, yet it is less able to credibly deter an adversary that outguns the US and its allies and friends and can attack at will US bases in the region including Guam.

Moreover, the US no longer has much of a tactical nuclear weapons arsenal that can act as a deterrent to conflict in North and East Asia.

Without a meaningful change in direction in countering potential nuclear-armed adversaries such as China and North Korea, American assurances to maintain the balance of power and protect allies and friends seem more a forlorn hope than a guarantee.



A gas-masked South Korean activist holds an anti-nuclear picket in front of Taiwanese and North Korean flags. Photo: AFP/Choo Yoon-Kong

Student-Led Moon Dust Shield Team Named Finalist in NASA Competition

(Continued from Page 19)

project lead and chair of the revived Caltech AIAA, says a project promptly fell into their laps when NASA announced the BIG Idea Challenge, and a group of undergraduates coalesced into a team. They had no previous experience in proposal writing and had to navigate a remote-only collaboration because of the COVID-19 pandemic, which led to hours-long Saturday "work-a-thons" over Zoom.

"Our first idea was a folding, origami-like electrostatic doormat that would take dust off astronauts' boots since most of the dust is going to be condensed down to their boots and lower legs," Tisdale says. Soon, though, the students realized that a surface that did not need to fold would be more efficient and adaptable. "They came up with very creative, innovative idea focusing on modularity," Chung says. "So, it's something like space Lego blocks or Tinker Toys. You can bring these types of 'simple' blocks or tiles and make something bigger or more complex." Chung aptly recalls the quote by Leonardo da Vinci, "Simplicity is the ultimate sophistication."

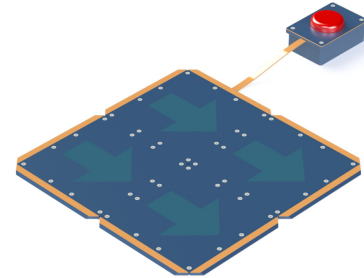
The students say access to mentors at Caltech and the Jet Propulsion Laboratory, which Caltech manages for NASA, was invaluable in guiding the project. Those experts encouraged the team to focus on the core function required and scrap any frills or embellishment. The mentors include JPL's Jason Kastner (PhD '03) and Manan Arya (MS '12, PhD '16), and former JPL director Charles Elachi (MS '69, PhD '71), Caltech professor of electrical engineering and planetary science, emeritus.

The mentors helped the students focus on proven materials and systems. For example, the tiles are made of aluminum oxide, a ceramic proven to be durable under space conditions. Because EDS systems have previously been used in experiments aboard the International Space Station, NASA rates it at as having a high "technological-readiness level," meaning there is high confidence and evidence that the system works in space.

In addition, the team also had the opportunity to interview astronaut and Caltech alumnus Robert Behnken (MS '93, PhD '97), who offered insights into the engineering standards used by NASA, for example, and practical advice on how astronauts might work with a system like HOMES while on a mission.

"He gave really good metrics about how you would handle these things and the reduced mobility you have in a spacesuit," Dulá says. "Another piece of advice he suggested: instead of having astronauts assemble this while in spacesuits, most

likely it would be assembled in an airlock." That way, she says, astronauts would not have to wear bulky suits while putting together the tiles. Once assembly is complete, they could take the HOMES tiles outside and place them wherever they are needed.



*Example of a 4x4 configuration of HOMES tiles
(Credit: Caltech HOMES team)*

Armed with up to \$180,000 in funding from NASA, the HOMES team now joins six other finalist teams in building a prototype version of their technology. Dulá notes that seven Caltech team members are located in or near Pasadena and are adhering to campus and county regulations in determining possible physical workspaces where the students can safely collaborate in person during the pandemic. Those seven will form a "ground crew" while the others collaborate remotely as a "support crew." If HOMES passes a mid-project review with NASA in May, the team will compete against the other finalists in Las Vegas this fall, assuming such an in-person gathering is safe by then.

Whatever happens next, Chung marvels at the fact that a group composed solely of undergraduates has thrived in a competition against many other university teams that include PhD students. "[JPL chief technologist] Fred Hadaegh opened the proposal and said, 'Did the undergraduate students write this proposal?'" Chung recalls. "This is amazing because they essentially worked together for only a month or two to come up with one of the most compelling dust mitigation ideas selected by NASA for development."

The HOMES team members include: Malcolm Tisdale, BS '23, Mechanical Engineering; Luis Pabon, BS '22, Mechanical Engineering; Isabella Dulá, BS '22, Mechanical Engineering; Polina Verkhovodova, BS '22, Mechanical Engineering; Leah Soldner, BS '24, Mechanical Engineering; Tanmay Gupta, BS '24, Physics; Nathan Ng, BS '24, Mechanical Engineering; Athena Kolli, BS '24, Mechanical Engineering; Kemal Pulungan, BS '25, Mechanical Engineering; Jules Pénot, BS '24, Mechanical Engineering; Calle Junker, BS '23, Mechanical Engineering; Kaila Coimbra, BS '23, Mechanical Engineering; Rithvik Musuku, BS '24, Mechanical Engineering; Parul Singh, BS '24, Mechanical Engineering

Countering Objections to Space Settlement

(Continued from Page 20)

Talking point 2: Mature space capabilities can, and often do, pay for themselves and then some. The first and most common objection to space settlement is that the billions of dollars of space money could be better spent feeding and housing people, providing medical care, etc. The simplest response is that most of society's resources should be, and are, expended on foods, shelter, health care, education, communication, transportation, etc. The United States has a multi-trillion dollar economy while NASA's budget is around \$24 billion. You can think of this money as seed corn.

Every year a subsistence farmer must plant their crop. The seed for that crop comes from the same corn the farmer's family eats. If they eat all the corn grown they will starve as there is no seed the next season. So a small fraction of the corn crop must not be eaten, no matter how hungry they are.

Similarly, NASA uses a small fraction of the country's resources to develop new capabilities and products and improve existing ones. NASA is focussed on space and aero vehicles which has led to immense improvements in transportation, communication, understanding the Earth, protecting Earth from asteroids, location services, and much much more.

The second response to this objection is that mature space activities pay for themselves and settlement can do the same. The classic example is communication satellites, which are the single largest arena of commercial space development. Comsats have earned profits for decades, paying back in taxes the government money spent to help them develop many times over. Earth resources satellites can also be quite profitable in addition to their vital role in understanding Earth's environment. Location and navigation satellites enable a thriving economy in ground devices, such as smartphones, that use the government owned and operated space GPS (Global Positioning System) to help people get to their desired location.

Objection: If we were meant to go to space, we would <fill in the blank>

Talking point: Our ability to make machines can take us into space.

The human body is poorly suited to space. If put in direct contact with the vacuum, radiation, and/or temperature extremes of space things will not go well and death is the usual result. However, the human body and mind are superbly suited to building machines, including machines that can create very livable worlds even in the hostile environment of space. Vacuum can be defeated by pressure vessels, radiation by mass or electromagnetic fields, temperature extremes by insulation, excessive heat by thermal radiators, and so forth.

Objection: We will mess space up just like we have Earth

Talking point: Space is mostly rock, radiation, and plasma. There are no local societies to oppress or living environments to 'mess up.'

The cosmos, stretching 53 thousand light years in this galaxy alone, is almost all plasma, rock, and radiation. There really isn't much that can be ruined, and there is an awful lot of it (about 100 billion stars in the Milky Way). At least in this solar system, there are no native tribes that could be oppressed or have their land stolen. There is no living environment that can be destroyed except, perhaps, microbes on Mars or a few moons. Parts of the space environment should be preserved for posterity, for example the Apollo landing sites. However, much of space suitable for settlements, for example the asteroids, can be freely exploited without creating loss to any living thing.

A critic might note that we have polluted small but important bits of space, namely Low Earth Orbit (LEO) and Geosynchronous Orbit (GEO). These have a debris problem in the form of derelict spacecraft, bits of junk, and debris from collisions and explosions. The situation causes no problems on Earth other than increased satellite operational costs. Furthermore, a number of missions to clear out the debris are in the works. There are also very large constellations (thousands of spacecraft) in development but considerable effort is being put into minimizing collisions. In any case, one can reasonably expect people living in space to be more concerned with the debris problem and in a better position to do something about it.

Life will change space as we move into it, just as life changes Earth. There are already foot prints and wheel tracks on the Moon and more are on the way. There are rovers and landers on Mars as well as thousands of working satellites in Earth orbit. Unless we abandon space development these changes will accelerate.

When life moved out from the oceans and onto land enormous changes took place on Earth. Changes that led to the existence of you, dear reader. There are those today who think changes are unacceptable; that any change is degradation and everything should stay as it is, or sometimes was, forever. Had this been the case in the past, humanity would be limited to Africa or, quite likely, extinct.

Objection: Having an alternative to Earth devalues Earth

Talking point: Earth is, by far, the best planet. It cannot be devalued.

(Continued on the next page)

Countering Objections to Space Settlement

(Continued from the previous page)

First, Earth is the best place in this solar system, and by an extremely large margin. There is no other place where one can breathe the air. No other place with large amounts of liquid water on the surface. No other place that grows any food at all. One could go on for some time. In short, Earth is the solar system's best planet.

Second, there are over seven and a half billion people on Earth. Building sufficient space settlements for such an enormous population would take a very long time and transporting them from Earth is an immense task. "Trash it and move on" is not a viable strategy for mankind.

Objection: Earth problems must be solved on Earth

Talking point: This is simply untrue.

For example, besides the day to day problems solved by communication and GPS satellites, Earth observation satellites make a huge contribution toward the vital task of understanding Earth to minimize the critical risks we face with regard to the climate crisis and a host of other environmental challenges.

Space is used to solve problems on Earth every day. This is not in some far off time, it is now.

Objection: Early settlers may become a resented elite (ala Elysium)

Talking point: It's a movie, not a documentary.

In the movie Elysium (2013), by 2154 the masses live in misery and squalor on Earth while privileged elite live in an enormous LEO space settlement with top notch health care, beautifully maintained estates, and a completely unrealistic, but vital to the story, illegal immigration problem. After a few centuries of space settlement, if Earth is allowed to degenerate, something similar could take place here.

The obvious solution is to not let Earth degenerate in such a way, which is a good idea in any case. It will be a long time before anything even vaguely like Elysium in the movie will be common in space. Given the proven track record of the last century or so in improving the human condition for billions of people, it is reasonable to expect that most people will be better off in 100 years than they are today, regardless of pollsters, if the environment is protected from the climate crisis and similar problems. While there may still be resentment, there should be a lot less squalor.

Objection: Those who grow rich on space development may be resented

Talking point: How do you become a space millionaire? Start out as a space billionaire.

Outside of launch, communications, and Earth observation, people are mostly spending money in space, not making it, but this will not necessarily continue forever. However, resentment of the more fortunate is not limited to space endeavors and the response likely should be similar for space and non-space cases.

It Cannot be Done

The second major class of objections is feasibility. Can space settlement be accomplished or is there some horrendous problem that cannot be solved?

Talking point 1: Space settlement is a massive engineering task, but there is no new physics needed and after decades of study no show stoppers have been identified. The necessary capabilities are within our grasp.

Talking point 2: Space settlement will be difficult but the rewards can be enormous.

Objection: Space farms cannot work reliably

Talking point: A problematic but adequate space farm has been demonstrated on Earth. Space settlements regardless of location need a farm to produce not only food but also clean water and oxygen, and must recycle wastes to become food again. This is an extraordinarily difficult task. Small settlements are particularly difficult to provide for because the life support system has small buffers of vital resources such as oxygen and water. If the space farm is very sensitive the whole system can become unstable and crash.

Fortunately there is one example of a ground based space farm experiment that, despite serious problems, was able to operate a mostly closed system supporting eight people in a three acre facility for two years. It was called Biosphere 2 and is largely considered a failure because they fell short of their original targets, had poor marketing, and did very unconventional science. But Biosphere 2 was an engineering success in that it more-or-less did what was hoped for on the first big try: keep eight people alive in an airtight system. An engineer's response to this situation is to try again, which they did for six months until outside pressures ended the experiment. So consider

1. Biosphere 2 was atmospherically closed. We know the atmosphere was recycled with very little loss because at about 16 months they had to import oxygen which was running low. If there was a lot of atmospheric leakage the oxygen level would have been the same as outdoors. The problem was that some of the concrete in Biosphere 2 was absorbing oxygen. Fixing the concrete, once the problem was understood, was easy.

(Continued on the next page)

Countering Objections to Space Settlement

(Continued from the previous page)

2. The first large Biosphere 2 experiment (or closure) did not produce enough food. The biospherians ate some of their emergency food supplies because they were starving. Before closure they did not understand the amount of physical work, particularly weeding, required to operate Biosphere 2 and they set calorie targets much too low. A second closure featured more area devoted to food production, and Biosphere 2 was able to feed eight biospherians on the second try.

3. The CO₂ level varied wildly but by dint of a great deal of work was controlled well enough.

4. Importantly, the Biosphere 2 closure experiments both had the same water at the end of the experiment as in the beginning.

So, there is no doubt that Biosphere 2 was pretty much closed to both air and water. In the second closure neither oxygen nor food was in such short supply compared to the first. There was some leakage, of course, and some material came in and went out (for example, biological samples), but no more mass exchange with the outside than a space settlement might experience.

Space settlements will strive for closure and effective recycling but neither will ever be perfect. That means that over long periods of time settlements will have to be resupplied with at least atmospheric constituents (mainly N₂ and O₂)

Objection: Humans cannot tolerate space radiation

Talking point: Settlers can be protected by radiation shielding.

Space radiation comes from a couple of different sources. One is our Sun, which emits dangerous levels of radiation from time to time requiring some sort of storm shelter for a few hours or days until the (space) weather improves. Without such a shelter the largest storms can kill an unprotected human.

There is also radiation trapped in certain orbits. The easiest mitigation approach is to avoid these belts (the van Allen Belts).

An important source of radiation is galactic cosmic rays (GCR) which come from all directions at levels that will not kill or even make you sick in the short term, but in the long term can cause increased cancer risk and other problems. This risk can be mostly avoided by using large amounts of water, regolith, or other material as radiation shielding. For example, in high Earth orbit seven tons of water per square meter of hull is needed to provide adequate shielding for settlers. However, in LEO near the equator (low inclination) radiation levels are so low that little or no shielding is required to get interior radiation levels acceptable for settlement⁵.

In short, living with the radiation in space is quite feasible although for free space settlements getting sufficient radiation shielding materials (millions of tons in most cases) to the construction site can be a significant logistical task. On a planet or moon local resources can be used to bury settlements in several meters of surface materials.

Objection: Humans cannot tolerate weightlessness

Talking point: Free space settlements can provide artificial gravity by rotating.

Free space settlements can be rotated to provide artificial gravity for settlers. This avoids a long list of problems astronauts have encountered being exposed to microgravity. The fastest rotation that makes sense is about 4 rpm (rotations per minute) which corresponds to a 112 m diameter to mimic 1g (Earth normal gravity). Faster rotation rates correspond to smaller diameters and the living area becomes very cramped. When exposed to rotation rates of up to 4 rpm many settlers may at first become ill but will usually recover within a few hours or a day or two. Even better, experiments on Skylab suggest that rotation in orbit is much more easily tolerated than on Earth.

Objection: Humans may not tolerate Lunar (1/6g) or Martian (1/3g) gravity

Talking point: Much more research is needed, and free space settlements can provide 1g.

Twelve men have experienced lunar gravitation levels (about 1/6g) for a few hours or a couple of days. Determining the health effects of reduced gravity will require far, far more experience and research for adults much less children. However, if it is determined that whatever problems are found can be mitigated adequately then the Moon and Mars may become appropriate places to settle.

Objection: Free-space settlements will be hit by asteroids

Talking point: Asteroids big enough to be dangerous are rare and can be deflected.

By one estimate, in free space small meteoroids (<10 grams) will hit a settlement about once every two years. But the damage from small meteoroids should be easy to repair in plenty of time to save the settlement. Large meteoroids (asteroids) are expected to hit about once every million years. Tracking of asteroids is already routine although not as extensive as it should be and techniques for deflecting dangerous asteroids are already in development to protect Earth.

(Continued on the next page)

⁵ See <http://space.alglobus.net/papers/RadiationPaper.pdf>

Countering Objections to Space Settlement

(Continued from the previous page)

There is one important exception. Early settlements may be in LEO⁶ below about 750 km where there is significant amounts of man-made debris presenting an existential threat to free space settlements. It is possible, but expensive, to clean LEO of debris.

Objection: People need X

Talking point: People are incredibly varied in what they can live with. X can be any of many, many things that people think they 'need.' This includes distinct seasons, a 24 hour day, sunshine, an immobile house to live in, contact with nature etc., etc. etc. The truth is that people can and often do live without all these things. Examples include Southern California which has no seasons to speak of, Northern Alaska where people live for months at a time with no sunlight, nomads who have no houses, city dwellers who rarely see a flower not planted by a gardener etc., etc., etc.

People live successfully in an amazing variety of ways, and space settlement will undoubtedly add more.

Power Plays

War and power politics will likely rear their ugly heads, but there is some reason to believe it will be less common in the age of space settlement.

Objection: Space war may break out

Talking point 1: Resource wars are less likely as the available resources in space are so enormous.

Talking point 2: The fragility of free space settlements will limit some classes of warfare.

It is unrealistic to expect that space settlement will put an end to war if only because mankind goes to war for many different reasons. However two factors are expected to keep the level of warfare under some control: the fragility of most space settlements, particularly free space settlements, and easy access to truly vast quantities of energy and material resources.

Settlements and other facilities on a moon or planet (including Earth) can be buried under large amounts of rock making them difficult to destroy and limiting the options of an aggressor. The pressurized hull of free space settlements will usually be protected by several meters of radiation shielding giving it some toughness, but thermal radiators and solar arrays will be extremely exposed and vulnerable, making such settlements a poor platform for combat. It should be noted that if a lunar or planetary settlement uses nuclear power and cool interior temperatures for cooling, these vulnerabilities are much less.

⁶ "Space Settlement: an Easier Way," by Al Globus, Stephen Covey, and Daniel Faber, *N SS Space Settlement Journal*, July 2017.

As described in the section on thriving, the resources of this solar system are enormous: billions of times the energy budget of Earth, and asteroidal materials sufficient to build new land hundreds of times the surface area of Earth. However, that's for only one star and there are around 100 billion stars per galaxy. Thus, it is hard to imagine a situation where it will be easier to steal resources than to develop them. For example, by putting up a solar array one can access the Sun's energy. Alternatively one could attack someone with a solar array and steal theirs, but there are a wide variety of things that can go wrong and building one's own is expected to be a lot easier and more reliable than fighting over it.

Objection: Space settlements may attack Earth

Talking point: Earth needs to know when to let go.

Early settlements will necessarily be an extension of earthbound organizations, probably governments and perhaps corporations. The number one most likely reason for space settlements to attack Earth is a desire for independence. The model most likely to avoid such wars is the Canadian, New Zealand and Australian models where independence was achieved gradually with very little if any violence. The American model, which involved years of full scale warfare, is not the ideal. Thus, Earth needs to let go of settlements and wish them well when the time for independence comes.

Objection: A strong man may take over a settlement

Talking point: the right to leave is essential and may be sufficient.

It may be quite possible for a cult, probably headed by a charismatic leader, to take over a space settlement. This sort of thing happens on Earth all the time. Worse, it will probably be relatively easy to cut a settlement off from outside influences, at least for the small early settlements.

Takeovers are likely to be relatively bloodless as any serious fighting in a settlement may breach the pressurized hull (necessary on moons and planets not just in free space). Then the settlement would begin to lose atmosphere and everyone would need to deal with the hull or die.

An interesting question is: what is the smallest set of rights that settlers in a cult-run settlement need? Possibly just the right to leave. If this right were vigorously enforced (which may be quite difficult) then settlements with a repressive regime would tend to lose population, particularly among those critical settlers who know how to maintain and repair the settlement.

(Continued on the next page)

Countering Objections to Space Settlement

(Continued from the previous page)

Objection: Deudney threatens

Talking point: a solar system with space settlement is far safer than one without.

Dark Skies: Space Expansionism, Planetary Geopolitics, and the Ends of Humanity by Daniel Deudney uses geopolitical theory to argue that space settlement would all but inevitably create threats that lead to war, destruction, and perhaps the extermination of humanity. However, this book fails to compare the total threat with and without space settlement, minimizing the positive effect on survival that space settlement has -- the ability to help recover from global devastation. The threats Deudney examines are considered one at a time, not as the sum of all threats. He also grossly inflates the utility of asteroids as weapons. In any case, when the total threat is examined it becomes overwhelmingly obvious that the risks we face without settlements -- multiple paths to the extermination of civilization and even humanity with no way to recover -- completely overwhelms the risks with space settlements.

For a much more detailed critique of Deudney's *Dark Skies* see [Not So Dark Skies](#) published in Space Review July 2020.

Miscellaneous

Objection: People need nature

Talking point: City dwellers have little contact with nature today.

There are many people who live in a big city and rarely see a plant or animal that was not put there by a human hand. However, contact with nature is certainly desirable and many cities have large parks, for example, central park in New York, where city dwellers can get some exposure to something fairly close to nature.

After many generations of space settlements growing bigger and bigger, settlements could have large open spaces that are let run wild. Although the starting seed may be distributed by mankind, the evolution of the area could provide some valuable natural-feeling spaces.

Objection: People cannot get along in tiny initial space settlements

Talking point: Some people do get along in small spaces.

The island of Santa Cruz del Islote off the coast of Colombia has 1,200 inhabitants on an island the size of two soccer fields. Locals say the island is peaceful and calm, there are no

police and essentially no crime. Everybody knows everybody and the residents reportedly love it.

That said one should expect problems when people are crowded together in a small space. Space settlements will be a nearly ideal environment for investigation of various ways to 'get along' so in time we may be able to substantially improve our ability to work together.

Objection: Aliens

Note: With an estimated 40 billion planets in the habitable zone⁷ in this galaxy alone the possibility of alien space faring civilizations cannot be ignored. Contact with such a civilization is incredibly dangerous.

Talking point: Given enough time, a space settlement based civilization may become strong enough to survive encountering an alien civilization.

In the early millenia of creating an interstellar space settlement civilization we run an increased risk of being noticed by an alien civilization (if they haven't already found us tracking our TV and radio broadcasts). Once noticed there are a number of paths forward most of which end very badly for us. Consider the fate of many indigenous peoples on Earth. However, this assumes the alien civilization is much stronger than ours which may only be true early on. After sufficient interstellar space settlement construction (millenia or more) it is we that may be the strongest party in such contact.

If there is a malevolent civilization among the stars we had better find it before it finds us and we need to be as spread out and strong as possible. In this case vigorous space settlement development is vital. In scenarios where the aliens are tolerant or even well disposed to newcomers it is essential to treat the aliens with respect and kindness to hopefully avoid being squashed like a bug. If there are no alien life forms out there then we have a duty to protect the only life in the universe, ours. That means building space settlements and lots of them!

Objection: Space settlements may crash into Earth

Talking point: The vast majority of space settlements cannot come down on Earth.

The vast majority of space settlements are expected to be much too far from Earth to crash into it under any plausible scenario. However, in the early days of space settlement, settlers may take advantage of parts of LEO that have low radiation levels⁸.

⁷ The 'habitable zone' around a star is where liquid water can exist on the surface. Planets in this zone have at least some chance of supporting the development of life.

⁸ "[Space Settlement: an Easier Way](#)," by Al Globus, Stephen Covey, and Daniel Faber, [NSS Space Settlement Journal](#), July 2017.

(Continued on the next page)

Countering Objections to Space Settlement

(Continued from the previous page)

The radiation protective effect is particularly strong very close to the equator. This area is called equatorial low Earth Orbit (ELEO). ELEO settlements will be low enough that they cannot simply be abandoned because they would come down to Earth in a spectacular but devastating display. They will need reboost, which is a straightforward task. At the end of life they will need to be recycled as even a small space settlement will weigh thousands of tons.

Objection: This space settlement picture has a flaw

Talking point: Such pictures are artist conceptions, not engineering designs.

It is common to create beautiful images of life in a particular space settlement design. While these images serve an important function they often have technical problems. They are not engineering design documents! It is reasonable to ask that they are more-or-less right for some aspects of settlement life; however, there are usually substantial imperfections with regard to technical accuracy and often the design was to illustrate a particular partial solution anyway. This does not mean the settlement is doomed to failure. Usually it just means the design is incomplete. The only issue is whether

these problems can be resolved, which they usually can be. In those cases where they cannot be resolved at a reasonable time scale the design can be abandoned and another substituted in its place.

Objection: Space settlements are not natural

Talking point: To the kids their space settlement will be perfectly 'natural.'

A space settlement is an unnatural place -- to those that don't grow up in one. To kids born and raised there they will be as natural as 1,2,3 just as kids living in the mountains or a big city will think of their wildly divergent environments as being natural.

Summary

In short, there are many potential objections to space settlement, but there are valid responses to each of them. While some responses are more robust than others, the evidence points to vast benefits from our expansion into space. Talk openly and intelligently to the doubters, listen to them closely, for it is time to begin our greatest journey yet—our expansion beyond our home planet.

Photography Gallery: Dr. Robert Q. Fugate (1 of 3)

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

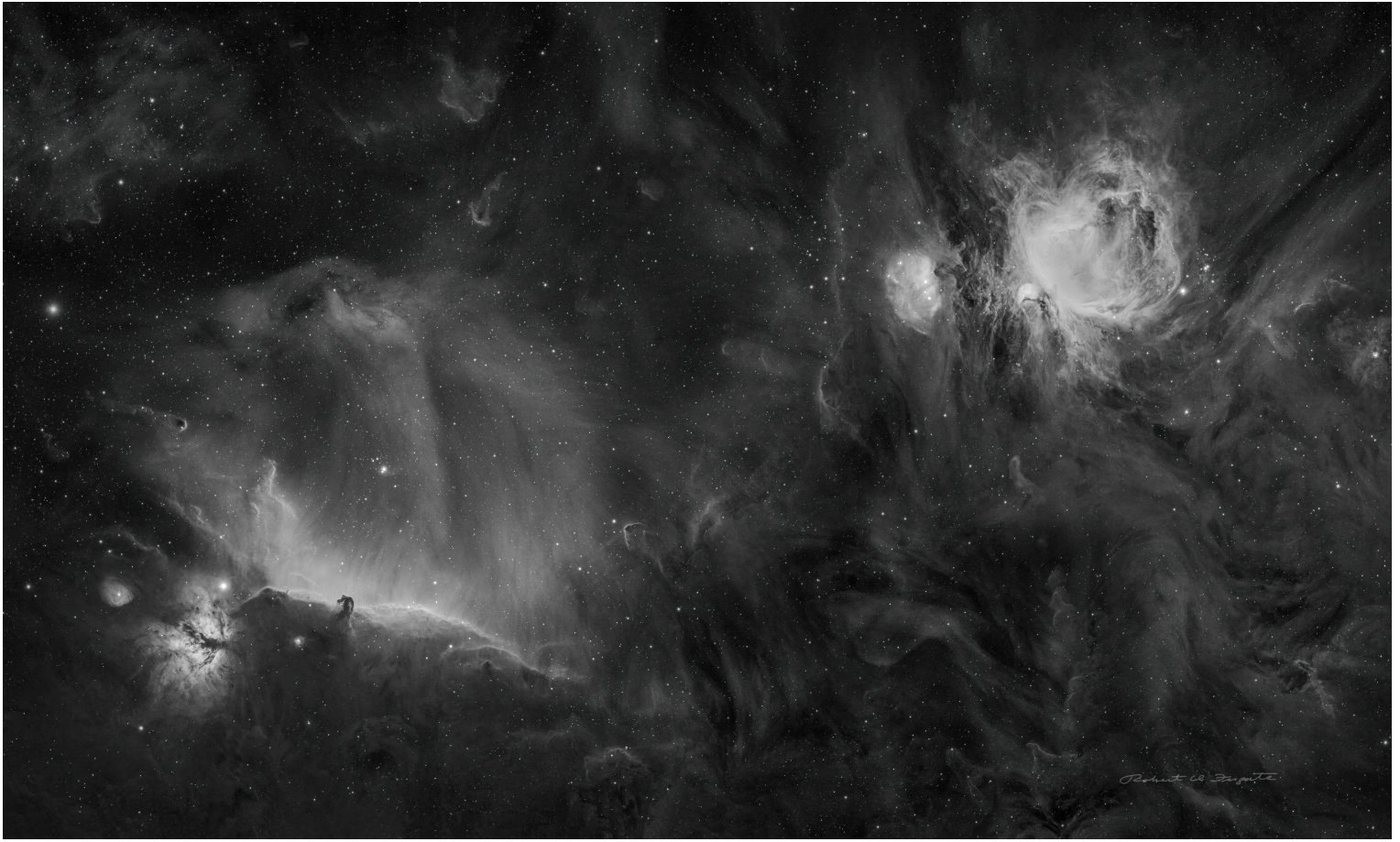
Dr. Robert Q. Fugate has a 49-year career in electro-optics research, 35 years as a civilian scientist at the Air Force Research Laboratory and now consultant for DoD, academia, and industry. He is recognized as the “Father of Laser Guide Star Adaptive Optics,” the key technology that has enabled a revolution in extremely large ground-based telescopes to see clearly through the turbulent atmosphere. At AFRL he led the development of practical adaptive optics systems on 1.5 and 3.5-m telescopes for space situational awareness at the Starfire Optical Range, Kirtland AFB, NM. He has been the DoD’s strongest advocate of adaptive optics technology transfer to the astronomy community. Recently he serves as the Co-Chairman of the Laser Committee at Project Breakthrough Starshot, an ambitious multi-decade effort to send small spacecraft to the nearest stars at 20% light speed using laser propulsion from a multi-gigawatt class ground based laser system. He has authored over 100 technical papers, given countless invited talks, and received many awards, including a Distinguished Presidential Rank Award. He is a member of the National Academy of Engineering, and Fellow of OSA and AFRL. The asteroid 6770 was renamed 6770 Fugate to honor his contributions to the astronomy community. Bob has a passion for deep space astrophotography, migratory birds, and southwestern landscapes. He has two international magazine covers, is an invited contributor to Healing Images, and has won the Photographic Society of America’s highest award.



Laser Guide Star Adaptive Optics at the Starfire Optical Range

A laser beam is projected from the 3.5-m telescope at the Starfire Optical Range at Kirtland AFB, NM to create an artificial guide star for the adaptive optics system. The laser excites sodium atoms (replenished by micrometers) in the mesosphere, 90 km above the earth’s surface. The artificial guide star is essential for sensing rapidly changing wavefront aberrations caused by atmospheric turbulence, permitting fast deformable mirrors to correct the aberrations in real time. This technology was pioneered at the SOR for space situational awareness but is now in widespread use throughout the astronomy community. Laser guide star adaptive optics has created a revolution as the enabling technology for making extremely large telescopes scientifically productive in their quest to unravel the mysteries of the Universe. ([Next Page](#))

Photography Gallery: Dr. Robert Q. Fugate (2 of 3)



The Orion Molecular Cloud in Hydrogen-Alpha Light

In this photo we are looking at clouds of excited and ionized hydrogen in the constellation of Orion. On the lower left is the Horse Head nebula and at the upper right is the Great Nebula in Orion (often depicted as part of Orion's sword) easily visible to the unaided eye. The image was made through a narrow (3 nm) optical filter centered on the 656 nm hydrogen alpha emission line. The Horse Head Nebula is a giant cloud of dust - but no small one. It is about 5 light years high, about 2.5 times the diameter of our solar system. The two brightest stars on the left side of the image (one just to the left of the Horse Head and above the Flame Nebula (Alnitak) and one centered at the left edge of the image (Alnilam) are the left most and middle stars in Orion's belt. This region is about 1350 light years from Earth.

Magnetic fields from Sigma Orionis (the star just above the Horse Head Nebula) create channels for the flow of the hydrogen, generating foreground streaks against the glow of the background. The outflow above the cloud shelf the Horse Head sits on is about 35 light years high. We also see shock waves in the surrounding gas. These are more completely described as magnetohydrodynamic shock waves and are relatively common in molecular clouds and star forming regions. These are pressure driven disturbances propagating in the ambient medium with a speed greater than that supported for compressive waves in the unperturbed gas - like the bow wave in front of a supersonic aircraft. It's complicated, but makes beautiful structures.

The hydrogen-alpha emissions from the Great Nebula is powered primarily by the four stars at its core called the Trapezium, one of which is a very hot and powerful O-type star. This picture spans about 160 light years horizontally. This region is a stellar nursery, and personifies the essence of Creation.

Technical Details: Three panel mosaic. Images collected in my backyard in the northeast heights of Albuquerque, NM. The camera is the fantastic ZWO ASI6200MM (monochrome, 62 megapixel, backside illuminated, thermoelectrically cooled, Sony CMOS chip) and the telescope is a 4-inch refractor, 530mm focal length, f/5 Takahashi FSQ-106EDX4. The filter is housed in a 7-position remotely controlled filter wheel. I also use a Prima Luce Sesto Senso 2 autofocuser attached to the telescope focusing mechanism. The mount is an old but incredible Software Bisque Paramount ME. All hardware is controlled by a Raspberry Pi riding on the mount but operated remotely from my office on a home built linux computer running the open source INDI Ekos software. Connection to the RPi at the telescope is made using an ethernet over power line adapter at the end of a 50 foot extension cord in the backyard. The Ekos software also does plate solving in real time and manages the image acquisition schedule - a lifesaver when doing mosaics. This mount tracks the sky so well, I can make 10 minute unguided exposures. The image has 2 hours of total integration - each panel of the mosaic was eight 5 min exposures. Images were calibrated, aligned, integrated, background subtracted (almost not needed for the 3 nm Chroma filter), and stretched in PixInsight. The software Astro Pixel Processor is the standard for building complex mosaics for astrophotography, but for this image I just used Adobe Lightroom.

(Continued on the next page)

Photography Gallery: Dr. Robert Q. Fugate (3 of 3)



Milky Way Over Fajada Butte

Best viewed on a large monitor. This is the view from the Visitors Center at Chaco Culture National Historical Park, New Mexico, USA. This image was made about 12:30 AM on June 1, 2019 during The Albuquerque Astronomical Society's bi-annual star party at Chaco. The Milky Way is unusually bright to the naked eye since Chaco Canyon is so dark. The trails formed by interstellar dust are especially black and contrasty. Bright Jupiter now closest to Earth, dominates the scene.

Fajada Butte on the right rises 380 feet above the desert floor to an altitude of 6624 feet above sea level. It is home of the Sun Dagger solstice marker which produces a dagger of sunlight through the center of a spiral petroglyph for 18 minutes on June 21. At the winter solstice, it produces two daggers centered on the spiral. The solstice marker is made of three large slabs of granite, precisely positioned to form two slits for sunlight to pass through at noon and illuminate the petroglyph behind them. This marker is about 1,000 years old.

This image is a composite made from a single exposure of the foreground landscape and a stack of averaged sky images obtained while the camera was tracking the sky on a small tripod mounted tracker. The Moon was below the horizon. There was considerable green and red airglow earlier in the evening but the airglow had largely subsided by midnight except for the reddish band at the lower right in the picture, and the bands produced by airglow in a single image are smoothed by averaging images.

Image details. Camera: Nikon D850 set to ISO 400. Lens: Sigma Art 40mm F1.4 set to F1.4 (this is an incredibly sharp lens wide open). Sky Watcher Star Adventurer tracker with counter weight. Foreground exposure: 6 minutes, tracker off. Sky exposure 18 images at 2 minutes each. The sky images were calibrated, debayered, aligned, integrated, color calibrated, and stretched with an arcsinh profile in PixInsight. The images were combined in Photoshop and a few minor adjustments were made on the flattened image with luminosity masks.

Chaco Canyon is a mystical place - well worth your time to visit and experience what the Anasazi experienced and learn why they selected this beautiful valley to live their life and promote their culture.

Photography Gallery: Ms. Michelle Evans (1 of 2)

Ms. Michelle Evans

AIAA Distinguished Lecturer | Author, "The X-15 Rocket Plane, Flying the First Wings into Space"

(<https://www.aiaa-lalv.org/september-28-2020-aiaa-member-spotlight-on-michelle-evan/>)



A nice photo on a mother hummingbird showing off the iridescence under her chin. (2021 April 11)

(Continued on the next page)

Photography Gallery: Ms. Michelle Evans (2 of 2)



Two hummingbird eggs in a new nest in the photographer's backyard.



The photographer's cat also wanted to see what's in the trees.

Poetry by Steven Gelb

Steven Gelb is a retired aerospace engineer from the Hughes Aircraft Company and the BOEING Company. He specialized in computer analysis and performance predictions of spacecraft solar arrays for approximately 35 years.

"The Stars Yet To Come"

*By Steven Gelb
(Copyright 1994)*

The Hubble Space Telescope's unblinking eye
Sees Jovian impacts and comets that die.
Sees nurseries of planets and galaxies, too.
Sees things that we hoped for and things that we knew.

But what of the things that we don't comprehend?
And what of the wonders these messengers send?
What of the new stars far out in the nights?
What of new beings and what of new lights?

These are the things that Science is for!
These are the things that open the door!
These are the things of yesterday's lore!
These are the things to make our hearts soar!

So what will The Hubble now find to amaze?
And what are the wonders to fall in its gaze?
The Stars Yet To Come will be more than we know!
But they'll blaze with our hopes in a dazzling glow!

"The Music Of The Spheres"

*By Steven Gelb
February 24, 2021
(About Music)*

Perseverance touched down this week,
On the barren brown surface of Mars.
It carries two "mics" to hear windy sounds,
And to play wistful music of stars.
"The Music of the Spheres" means so much today,
Now that we have true access to space.
The planets resemble stark choirs, themselves:
Each playing a "lyre" with grace.

Venus, one knows, is as hot as it gets,
It is covered with clouds and it "stews".
Would a saxophone play as "hot" and as loud,
With a jazz band to belt out the blues?
Jupiter, the largest planet of all,
Boasts bands and a Red Spot, to boot!
How would a massive tuba create,
Bass blowouts with no substitute?

Saturn, with splendid rings around its waist,
Is a beautiful sight to behold.
Its rings resemble a Theremin's loops,
With a waveform more precious than gold!
Mars, we have seen, may be teeming with life,
Though this is not fact, as of yet.
The snare drum, most clearly, is lively enough,
As a Martian one never has met!

"The Music of the Spheres" readily resounds,
When the planets are playing their psalms.
The chosen "lutes" follow the planets' own traits,
And wander where they may belong.
As we may have seen, it takes some hard work,
To grasp and to comprehend,
How the cosmic clockwork may run,
And how its music may blend!

RSVP and Information: <https://conta.cc/3aEbLHM>
AIAA LA-LV e-Town Hall Meeting 5/15 (Online on Zoom)

Mars Atmosphere and Climate: Past, Present, and Future

by

Prof. Bruce M. Jakosky

NASA MAVEN's Principal Investigator

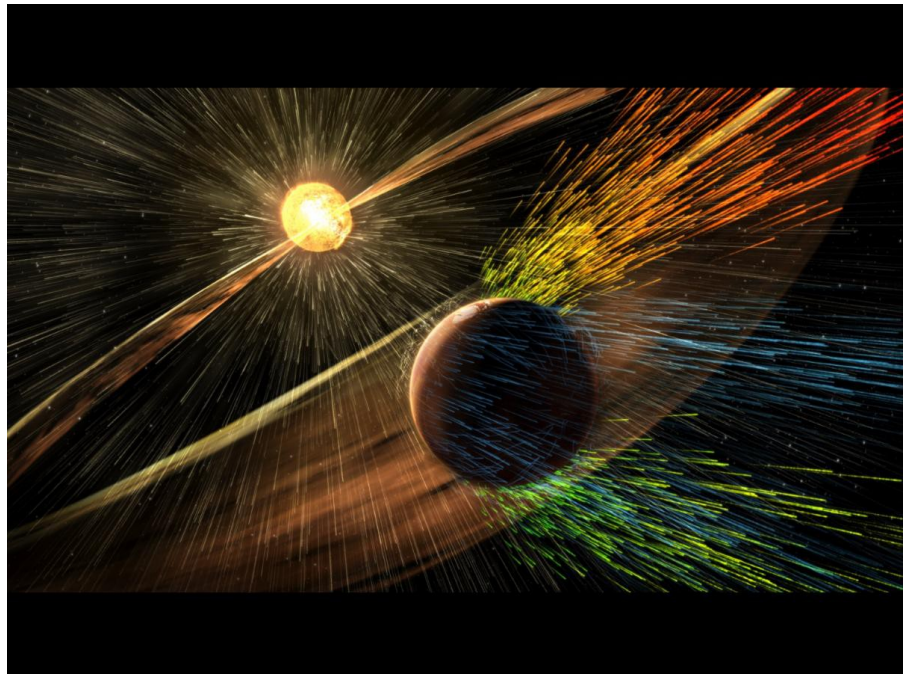
Professor of Geological Sciences

Associate Director for Science

Laboratory for Atmospheric and Space Physics

University of Colorado

Saturday, May 15, 2021, 10 AM PDT (US and Canada) (GMT -0700)



Geological and geochemical evidence points toward Mars having had a warmer and wetter climate early in its history, in which liquid water could flow and was abundant. This compares to today's very cold and dry that cannot support stable water. What caused this change in climate? Where did the water go? Where did the CO₂ from an early greenhouse atmosphere go? And is it possible to mobilize CO₂ remaining on the planet back into the atmosphere and "terraform" Mars to make a more clement climate? I'll discuss the evolution of the Martian atmosphere and climate, integrating results from numerous recent spacecraft missions.

Tentative Agenda (All Time PDT (Pacific Daylight-Saving Time, US and Canada))

10:05 AM PDT: Welcome

10:10 AM PDT: Prof. Bruce M. Jakosky

11:40 AM PDT: Adjourn

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

Contact: Dr. Ken Lui, Events/Program Chair, LA, AIAA LA-LV Section (events.aiaalav@gmail.com)

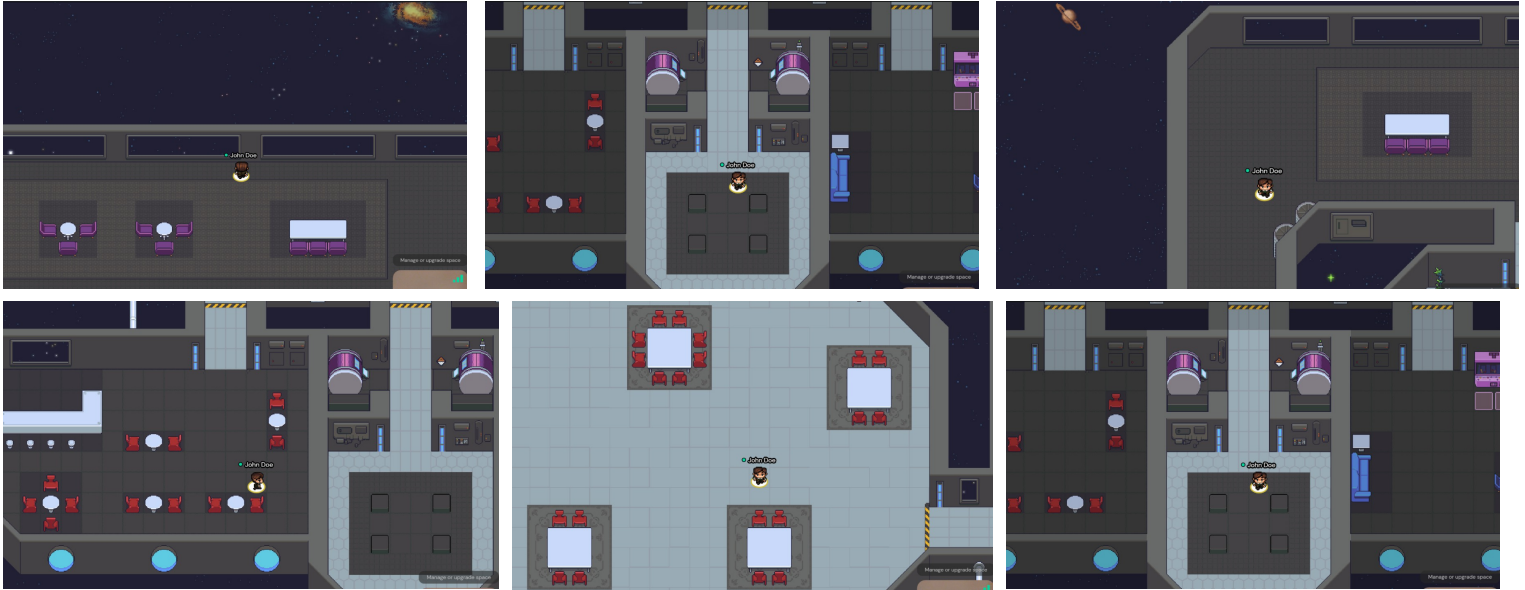
<https://aiaa-lalv.org/events>, <https://engage.aiaa.org/losangeles-lasvegas>, <https://aiaa-lalv.org/download>

RSVP and Information: <https://conta.cc/3ubWT1o>

AIAA LA-LV e-Happy Hour 5/20

AIAA LA-LV e-Happy Hour in a virtual Space Station !

Thursday, May 20, 2021, 6:30 PM PDT (US and Canada) (GMT -0700)



In the prolonged COVID-19 Pandemic, it's important to connect and support each other, and network / socialize. Please join us and try out this new way of virtual networking and see if you like it!

Please RSVP / register and join us online on May 20. The first 20 registrants will be free admission. Additional attendees will need to purchase the ticket of \$2 each. If you sign up free but can't make it, please inform us so another person can attend with the free admission. The URL, password, and instruction will be emailed to you on Monday, May 17, a few days before the event. Please check the email Spam or Junk folder at that time if you don't see it in your email Inbox.

You will be able to meet, chat, networking, and socialize with a computer web browser, camera, microphone / speaker, and a high speed internet, similar to join a Zoom meeting with a link and code to be provided a few days before the event. And a keyboard (a real keyboard or a virtual keyboard) is needed to move around in the virtual meeting facility. If your computer is ok for a Zoom video / audio meeting (or similar), it will be ok for this as well.

Please join us and give it a try. And help us to try out for a different new way of networking, socializing, and meeting. It will be fun. Thank you very much ! Look forward to meeting you there in this e-Happy Hour! Enjoy!

Tentative Agenda (All Time PDT (Pacific Daylight-Saving Time, US and Canada))

6:30 PM PDT: Open Door / Floor / Networking / Socializing

8:30 PM PDT: Adjourn

Contact: Dr. Ken Lui, Events/Program Chair, LA, AIAA LA-LV Section (events.aiaalalv@gmail.com)
<https://aiaa-lalv.org/events>, <https://engage.aiaa.org/losangeles-lasvegas>, <https://aiaa-lalv.org/download>

RSVP and Information: <https://conta.cc/3gS7OTJ>**AIAA LA-LV e-Town Hall Meeting 5/22 (Online on Zoom)**

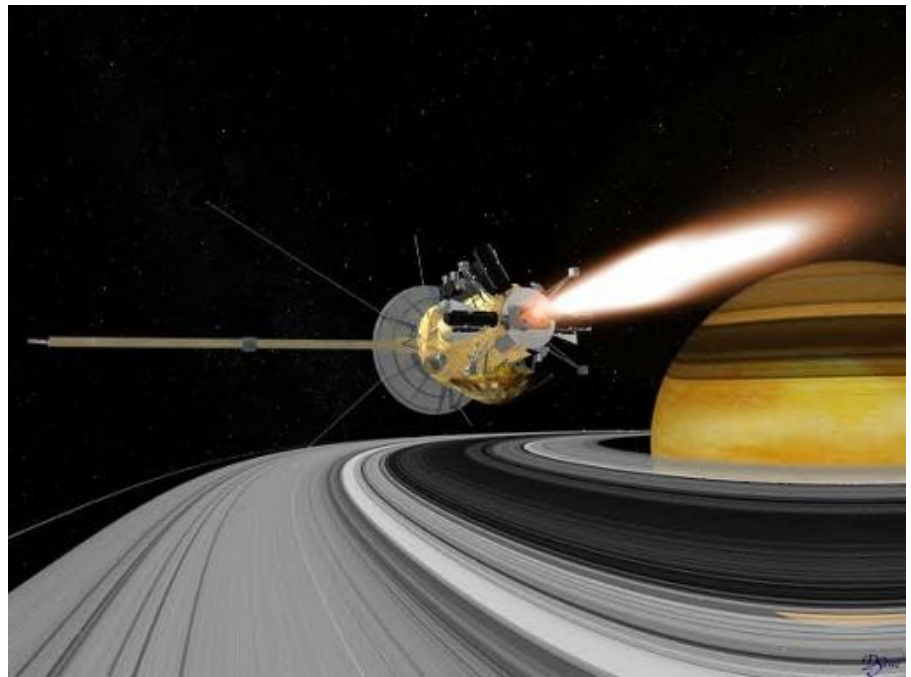
Space Nuclear Power & Propulsion

*by****Joseph A. Sholtis, Jr. LtCol, USAF(Ret)***

Sholtis Engineering & Safety Consulting

Associate Fellow of AIAA

a member of the AIAA Aerospace Power Systems Technical Committee

Saturday, May 22, 2021, 10 AM PDT (US and Canada) (GMT -0700)

This presentation will address, using figures, photos & videos, the notable 60-year history of the development & use of nuclear systems for power, heating, and propulsion in space -- principally by the U.S., but also briefly by the former Soviet Union & Russia. U.S. space nuclear systems, as well as nuclear-powered/heated space missions flown, will be illustrated & described, along with major discoveries gleaned; and future nuclear systems, along with their potential space applications, will be briefly depicted and addressed.

Tentative Agenda (All Time PDT (Pacific Daylight-Saving Time, US and Canada))

10:05 AM PDT: Welcome

10:10 AM PDT: Joseph A. Sholtis, Jr. LtCol, USAF(Ret)

11:40 AM PDT: Adjourn

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

Contact: Dr. Ken Lui, Events/Program Chair, LA, AIAA LA-LV Section (events.aiaalav@gmail.com)

<https://aiaa-lalv.org/events>, <https://engage.aiaa.org/losangeles-lasvegas>, <https://aiaa-lalv.org/download>

RSVP and Information: <https://conta.cc/3t9OweJ>**AIAA LA-LV e-Town Hall Meeting 5/27 (Online on Zoom)**

The Challenges of Landing Perseverance on Mars

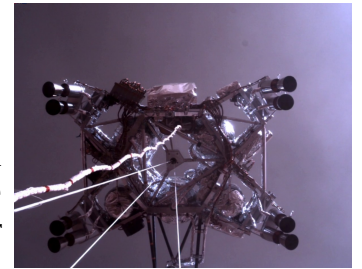
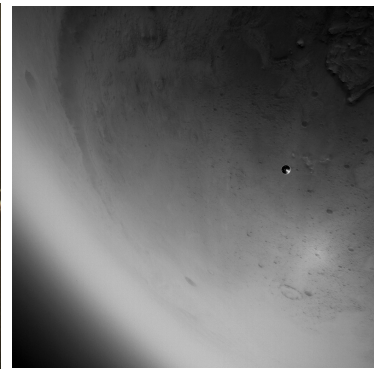
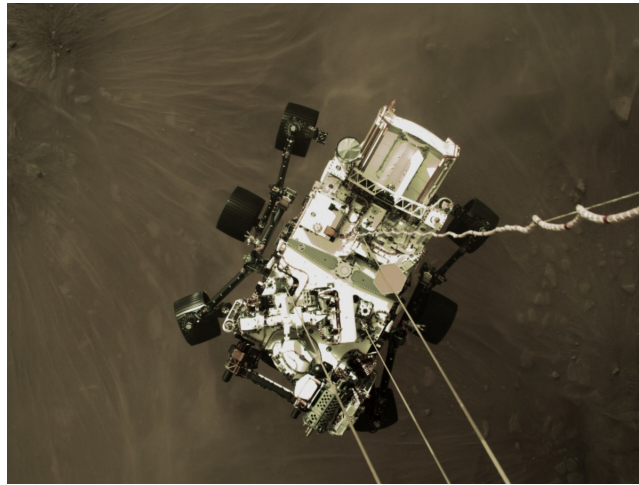
by

Mr. Allen ChenSystems engineer in the Entry, Descent, and Landing Systems and
Advanced Technologies group at the Jet Propulsion Laboratory

also with

Recognition of AIAA LA-LV Members of 25, 40, 60, and 70 years of Membership

by

Mr. Aldo Martinez (AIAA LA-LV Membership Chair; Boeing),
Dr. Jeff Puschell (AIAA LA-LV Section Chair, AIAA Fellow, Raytheon Intelligence & Space)***Thursday, May 27, 2021, 7 PM PDT (US and Canada) (GMT -0700)***

Mr. Allen Chen is a systems engineer in the Entry, Descent, and Landing Systems and Advanced Technologies group at the Jet Propulsion Laboratory. He is currently the Entry, Descent, and Landing (EDL) Lead for the Mars 2020 project. During his ten year tour of duty on the Mars Science Laboratory mission, he was the EDL operation lead, the EDL flight dynamics lead, co-led the joint science/engineering Mars atmosphere characterization team, was a member of the Flight System Systems Engineering team, and did play-by-play commentary for landing. He also worked on the Mars Exploration Rovers project, performing EDL reconstruction analysis and testing.

Tentative Agenda (All Time PDT (Pacific Daylight-Saving Time, US and Canada))

7:00 PM PDT: Welcome (Dr. Jeff Puschell)

7:05 PM PDT: Recognition of AIAA LA-LV Members of 25, 40, 60, 70 years of membership

7:20 PM PDT: Mr. Allen Chen

8:50 PM PDT: Adjourn

*Disclaimer: The views of the speakers do not represent the views of AIAA or the AIAA Los Angeles-Las Vegas Section.*Contact: Dr. Ken Lui, Events/Program Chair, LA, AIAA LA-LV Section (events.aiaalav@gmail.com)<https://aiaa-lalv.org/events>, <https://engage.aiaa.org/losangeles-lasvegas>, <https://aiaa-lalv.org/download>

RSVP and Information: <https://conta.cc/33144XN>

AIAA LA-LV e-Town Hall Meeting 6/5 (Online on Zoom)
Saturday, June 5, 2021, 10 AM PDT (US and Canada) (GMT -0700)

(1) Digital Transformation through MBSE

- ANSYS technology stack, workflows and use-cases

(2) Accidents Happen

- Inside the Process of an Airplane Accident Investigation

by

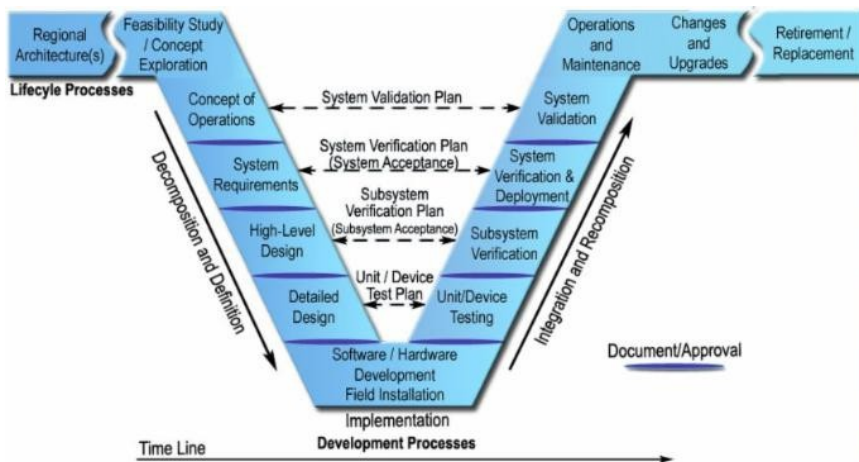
(1) Dr. Swati Saxena

Technical and Project Manager, ANSYS Inc.



(2) Mr. John Purvis

Retired, Accident investigation team, Boeing Commercial Airplanes
 Former AIAA Distinguished Lecturer
 Volunteer, Seattle Museum of Flight



Tentative Agenda (All Time PDT (Pacific Daylight-Saving Time, US and Canada))

10:05 AM PDT: Welcome

10:10 AM PDT: Dr. Swati Saxena (ANSYS and MBSE)

11:40 AM PDT: Mr. John Purvis (Airplane Accident Investigation)

01:10 PM PDT: Adjourn

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

Contact: Dr. Ken Lui, Events/Program Chair, LA, AIAA LA-LV Section (events.aiaalav@gmail.com)
<https://aiaa-lalv.org/events>, <https://engage.aiaa.org/losangeles-lasvegas>, <https://aiaa-lalv.org/download>

RSVP and Information: <https://conta.cc/3g13ZuN>

AIAA LA-LV e-Town Hall Meeting 6/12 (Online on Zoom)

Aerospace Projects in India:

Recent Developments and Future Plans

by

Prof. Rajkumar S. Pant

Aerospace Engineering Department
Indian Institute of Technology Bombay
Powai, Mumbai, India



Saturday, June 12, 2021, 9 AM PDT (US and Canada) (GMT -0700)



Left: Light Combat Aircraft (LCA) Tejas developed in India (Tejas-N is the aircraft carrier-based version) (image: Rushabh P Bafna); **Middle:** A Polar Satellite Launch Vehicle lifts off from the Satish Dhawan Space Center with the Amazonia 1 satellite and 18 secondary payloads. (Credit: ISRO); **Right:** Dr. Kailasavadivoo Sivan, Chairman, ISRO (Indian Space Research Organisation)

Prof. Rajkumar S. Pant has been a member of faculty of Aerospace Engineering Department at the Indian Institute of Technology Bombay since December 1989. He has also worked for five years in Hindustan Aeronautics Limited in the Design & Engineering Department. Prof. Pant is an alumnus of College of Aeronautics, Cranfield University, UK, where he earned his Ph.D. under Commonwealth Scholarship Scheme, and Indian Institute of Technology Madras, where he obtained his Masters in Aeronautical Engineering.

He has published and presented > 245 scientific papers, of which > 180 are in international journals and conferences. He was a visiting faculty for a year each at Nanyang Technological University in 2016, and Virginia Tech in 2010-11. He has also carried out several short-term assignments at several top-ranking institutes and universities all over the world such as Instituto Tecnológico de Aeronáutica, Brazil in 2012, Texas A&M University in 2011, Cambridge University in 2008, and Imperial College London in 2006. In 2102, he was appointed as a Special Visiting Researcher under the Science Without Borders program of the Brazilian Government for a three-year project.

Prof. Pant was honored with the D P Joshi Excellent Teacher Award in 2014, in recognition of his merit, achievements and enthusiasm for teaching and making a lasting impression on students. In 2019, he was felicitated by Institution of Engineers (India) as an Eminent Engineering personality in Aerospace Engineering. Recently, he has received Special Recognition in Academic Excellence (Faculty-National category) award by Institution of Engineers (India).

Tentative Agenda (All Time PDT (Pacific Daylight-Saving Time, US and Canada)) (GMT -0700)

09:05 AM PDT: Welcome

09:10 AM PDT: Prof. Rajkumar S. Pant

10:40 AM PDT: Adjourn

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

Contact: Dr. Ken Lui, Events/Program Chair, LA, AIAA LA-LV Section (events.aiaalav@gmail.com)

<https://aiaa-lalv.org/events>, <https://engage.aiaa.org/losangeles-lasvegas>, <https://aiaa-lalv.org/download>

RSVP and Information: (TBD)

AIAA LA-LV Juneteenth Event 6/19 (Online on Zoom)
Saturday, June 12, 2021, 10 AM PDT (US and Canada) (GMT -0700)



(Part I)

The Tuskegee Airmen

by

← **Mr. Harvey Hawks**

Historian for the Sam Bruce Chapter of the Tuskegee Airmen, Inc.
 Docent (tour guide and educator) at The Museum of Flight, Seattle

Boeing commercial airplane weight & balance analysis on SST, B747 and B767 programs – Retired
 formerly:

U. S. Army Missile Project Office

General Dynamics, Pomona

Aircraft Structural Design on DC-8 and DC-10 at Douglas Aircraft in Long Beach

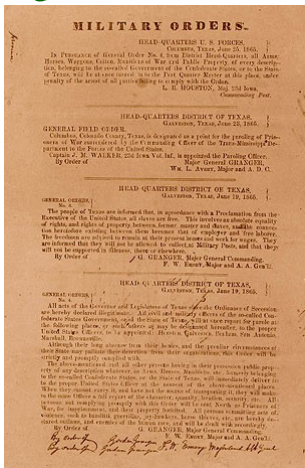


(Part II)

Juneteenth Celebration and African American Aerospace Professionals Panel Discussion

Panelists:

**Mr. Harvey Hawks,
 Pastor Marlin J. Ivy,
 Mr. Tyrone Jacobs Jr.
 and
 More TBA**



General Order No. 3,
 June 19, 1865



Gen. Lloyd James Austin III (Four-Star)
 28th United States Secretary of Defense
 (Not an event participant)

Tentative Agenda (All Time PDT (Pacific Daylight-Saving Time, US and Canada))

10:05 AM PDT: Welcome

10:10 AM PDT: The Tuskegee Airmen (Mr. Harvey Hawks)

11:40 AM PDT: Juneteenth Celebration and African American Aerospace Professionals Panel Discussion (Panelists)

01:00 PM PDT: Adjourn

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

Contact: Dr. Ken Lui, Events/Program Chair, LA, AIAA LA-LV Section (events.aiaalav@gmail.com)
<https://aiaa-lav.org/events>, <https://engage.aiaa.org/losangeles-lasvegas>, <https://aiaa-lav.org/download>



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

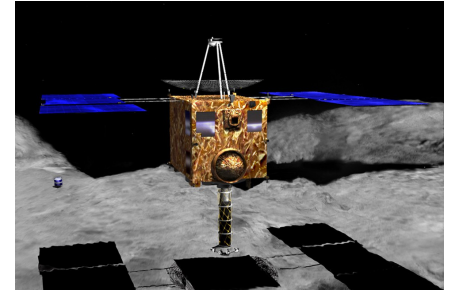
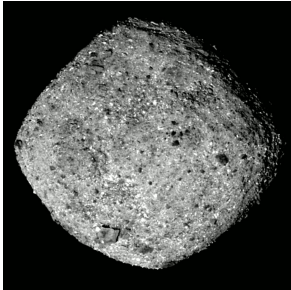
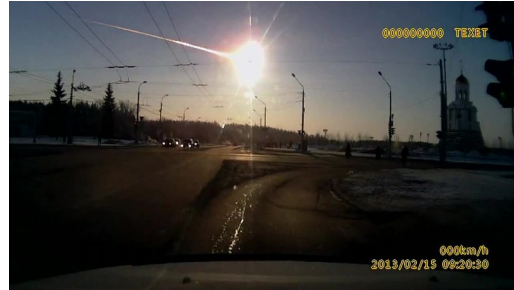
RSVP and Information: (TBD)

AIAA LA-LV Asteroid Day event (Online on Zoom)

Saturday, June 26, 2021, 10 AM PDT (US and Canada) (GMT -0700)

Planetary Defense Workshop

with Asteroid Exploration Updates



Dr. Nahum Melamed

Project Leader, The Aerospace Corporation

Dr. Paul W. Chodas

Director, Center for Near Earth Object Studies
NASA JPL

Prof. Madhu Thangavelu

Faculty Member and Director, USC / ISU

Mr. W. Randy Bell

Senior Project Leader, The Aerospace Corporation

Ms. Monica Maynard

LA School District STEM Director
STEM Office, The Aerospace Corporation

Ms. Lianne P. McGinley

Corp. Comm. & Public Affairs
Center of Excellence Associate Director
The Aerospace Corporation

Mr. Philip Groves

Asteroid Hunters" IMAX Producer & Writer,
Apophis Pictures, LLC

(More (TBD))

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

Contact: Dr. Ken Lui, Events/Program Chair, LA, AIAA LA-LV Section (events.aiaalav@gmail.com)
<https://aiaa-lalv.org/events>, <https://engage.aiaa.org/losangeles-lasvegas>, <https://aiaa-lalv.org/download>