

El Segundo, CA  
2021 November

# AIAA LA-LV Newsletter

## DART launched!

from Vandenberg AFB  
on November 23  
"1st Planetary Defense Mission"



## Space debris!

from Nov. 15 Russian ASAT  
test still threatens ISS

## Space warfare

AIAA LA-LV Webinar  
on November 6



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### History of Space Warfare

			
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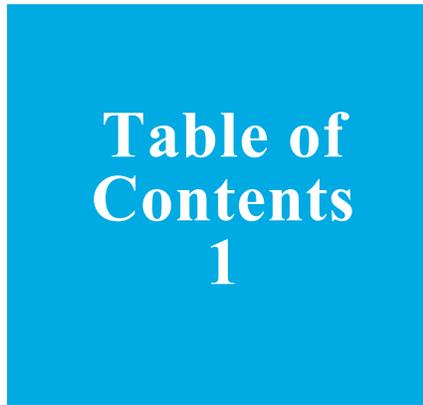
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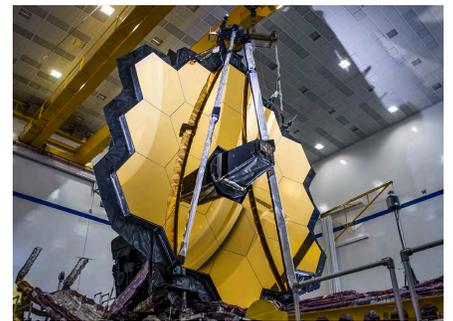
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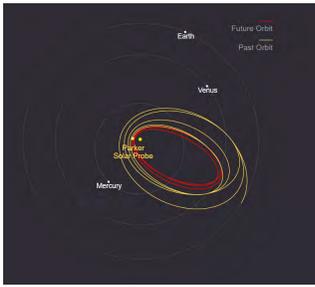
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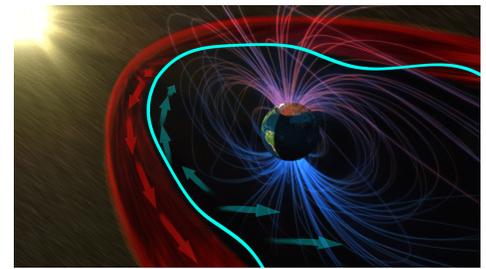
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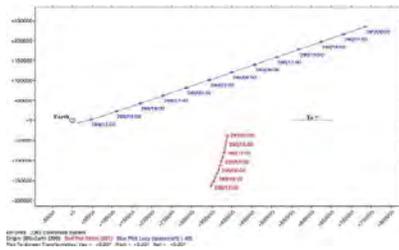
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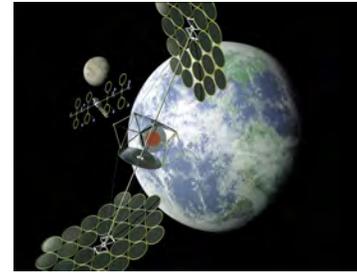
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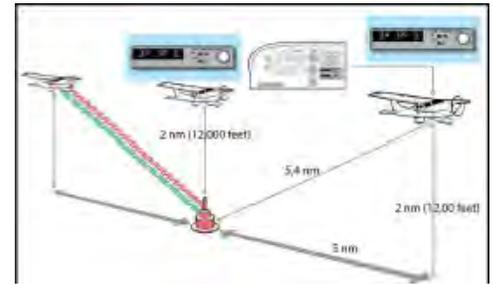
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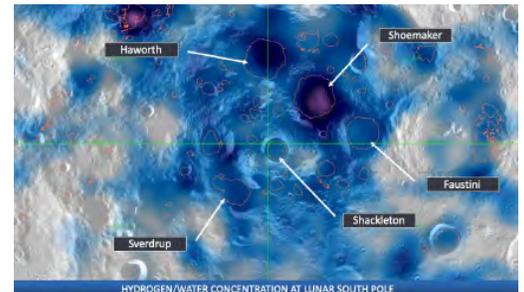
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## (Cover Story) NASA, SpaceX Launch DART: First Test Mission to Defend Planet

**Earth** <https://blogs.nasa.gov/dart/2021/11/24/nasa-spacex-launch-dart-first-planetary-defense-test-mission/>

by Linda Herridge, NASA, 2021 November 24

NASA's Double Asteroid Redirection Test (DART), the world's first full-scale mission to test technology for defending Earth against potential asteroid or comet hazards, launched Wednesday at 1:21 a.m. EST on a SpaceX Falcon 9 rocket from Space Launch Complex 4 East at Vandenberg Space Force Base in California.



A SpaceX Falcon 9 rocket lifts off from Space Launch Complex 4 at Vandenberg Space Force Base in California on Nov. 23, 2021, carrying NASA's Double Asteroid Redirection Mission spacecraft. Liftoff was at 10:21 p.m. PST. Photo credit: NASA

Just one part of NASA's larger planetary defense strategy, DART – built and managed by the Johns Hopkins Applied Physics Laboratory (APL) in Laurel, Maryland – will impact a known asteroid that is not a threat to Earth. Its goal is to slightly change the asteroid's motion in a way that can be accurately measured using ground-based telescopes.

DART will show that a spacecraft can autonomously navigate to a target asteroid and intentionally collide with it – a method of deflection called kinetic impact. The test will provide important data to help better prepare for an asteroid that might pose an impact hazard to Earth, should one ever be discovered. LICIACube, a CubeSat riding with DART and provided by the Italian Space Agency (ASI), will be released prior to DART's impact to capture images of the impact and the resulting cloud of ejected matter. Roughly four years after DART's impact, ESA's (European Space Agency) Hera project will conduct detailed surveys of both asteroids, with particular focus on the crater left by DART's collision and a precise determination of Dimorphos' mass.

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## (Cover Story) NASA, SpaceX Launch DART: First Test Mission to Defend Planet Earth

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“DART is turning science fiction into science fact and is a testament to NASA’s proactivity and innovation for the benefit of all,” said NASA Administrator Bill Nelson. “In addition to all the ways NASA studies our universe and our home planet, we’re also working to protect that home, and this test will help prove out one viable way to protect our planet from a hazardous asteroid should one ever be discovered that is headed toward Earth.”

At 2:17 a.m., DART separated from the second stage of the rocket. Minutes later, mission operators received the first spacecraft telemetry data and started the process of orienting the spacecraft to a safe position for deploying its solar arrays. About two hours later, the spacecraft completed the successful unfurling of its two, 28-foot-long, roll-out solar arrays. They will power both the spacecraft and NASA’s Evolutionary Xenon Thruster – Commercial ion engine, one of several technologies being tested on DART for future application on space missions.

“At its core, DART is a mission of preparedness, and it is also a mission of unity,” said Thomas Zurbuchen, associate administrator for the Science Mission Directorate at NASA Headquarters in Washington. “This international collaboration involves DART, ASI’s LICIAcube, and ESA’s Hera investigations and science teams, which will follow up on this groundbreaking space mission.”

DART’s one-way trip is to the Didymos asteroid system, which comprises a pair of asteroids. DART’s target is the moonlet, Dimorphos, which is approximately 530 feet (160 meters) in diameter. The moonlet orbits Didymos, which is approximately 2,560 feet (780 meters) in diameter.

Since Dimorphos orbits Didymos at much a slower relative speed than the pair orbits the Sun, the result of DART’s kinetic impact within the binary system can be measured much more easily than a change in the orbit of a single asteroid around the Sun.

“We have not yet found any significant asteroid impact threat to Earth, but we continue to search for that sizable population we know is still to be found. Our goal is to find any possible impact, years to decades in advance, so it can be deflected with a capability like DART that is possible with the technology we currently have,” said Lindley Johnson, planetary defense officer at NASA Headquarters. “DART is one aspect of NASA’s work to prepare Earth should we ever be faced with an asteroid hazard. In tandem with this test, we are preparing the Near-Earth Object Surveyor Mission, an space-based infrared telescope scheduled for launch later this decade and designed to expedite our ability to discover and characterize the potentially hazardous asteroids and comets that come within 30 million miles of Earth’s orbit.”

The spacecraft will intercept the Didymos system between Sept. 26 and Oct. 1, 2022, intentionally slamming into Dimorphos at roughly 4 miles per second (6 kilometers per second). Scientists estimate the kinetic impact will shorten Dimorphos’ orbit around Didymos by several minutes. Researchers will precisely measure that change using telescopes on Earth. Their results will validate and improve scientific computer models critical to predicting the effectiveness of the kinetic impact as a reliable method for asteroid deflection.

“It is an indescribable feeling to see something you’ve been involved with since the ‘words on paper’ stage become real and launched into space,” said Andy Cheng, one of the DART investigation leads at Johns Hopkins APL and the individual who came up with the idea of DART. “This is just the end of the first act, and the DART investigation and engineering teams have much work to do over the next year preparing for the main event – DART’s kinetic impact on Dimorphos. But tonight we celebrate!”

## (Cover Story) NASA, SpaceX Launch DART: First Test Mission to Defend Planet Earth

DART's single instrument, the Didymos Reconnaissance and Asteroid Camera for Optical navigation (DRACO), will turn on a week from now and provide first images from the spacecraft. DART will continue to travel just outside of Earth's orbit around the Sun for the next 10 months until Didymos and Dimorphos will be a relatively close 6.8 million miles (11 million kilometers) from Earth.

A sophisticated guidance, navigation, and control system, working together with algorithms called Small-body Maneuvering Autonomous Real Time Navigation (SMART Nav), will enable the DART spacecraft to identify and distinguish between the two asteroids. The system will then direct the spacecraft toward Dimorphos. This process will all occur within roughly an hour of impact.

Johns Hopkins APL manages the DART mission for NASA's Planetary Defense Coordination Office as a project of the agency's Planetary Missions Program Office. NASA provides support for the mission from several centers, including the Jet Propulsion Laboratory in Southern California, Goddard Space Flight Center in Greenbelt, Maryland, Johnson Space Center in Houston, Glenn Research Center in Cleveland, and Langley Research Center in Hampton, Virginia. The launch is managed by NASA's Launch Services Program, based at the agency's Kennedy Space Center in Florida. SpaceX is the launch services provider for the DART mission.

For more information about the DART mission, visit: <https://www.nasa.gov/dartmission>



*The SpaceX Falcon 9 rocket with the Double Asteroid Redirection Test, or DART, spacecraft onboard, is seen during sunrise, Tuesday, Nov. 23, 2021, at Space Launch Complex 4E, Vandenberg Space Force Base in California. DART is the world's first full-scale planetary defense test, demonstrating one method of asteroid deflection technology. The mission was built and is managed by the Johns Hopkins APL for NASA's Planetary Defense Coordination Office. Photo Credit: NASA/Bill Ingal*

# NASA Administrator Statement on Russian ASAT Test

2021 November 15

<https://www.nasa.gov/press-release/nasa-administrator-statement-on-russian-asat-test>



*Astronauts and experiments on the International Space Station work to make life better on Earth and help humanity explore deep into the cosmos. Credits: NASA*

On Monday Moscow Standard Time, the International Space Station (ISS) Flight Control team was notified of indications of a satellite breakup that may create sufficient debris to pose a conjunction threat to the station. NASA Administrator Bill Nelson released the following statement about the incident:

“Earlier today, due to the debris generated by the destructive Russian Anti-Satellite (ASAT) test, ISS astronauts and cosmonauts undertook emergency procedures for safety.

“Like Secretary Blinken, I’m outraged by this irresponsible and destabilizing action. With its long and storied history in human spaceflight, it is unthinkable that Russia would endanger not only the American and international partner astronauts on the ISS, but also their own cosmonauts. Their actions are reckless and dangerous, threatening as well the Chinese space station and the taikonauts on board.

“All nations have a responsibility to prevent the purposeful creation of space debris from ASATs and to foster a safe, sustainable space environment.

“NASA will continue monitoring the debris in the coming days and beyond to ensure the safety of our crew in orbit.”

The crew was awakened and directed to close the hatches to radial modules on the station, including Columbus, Kibo, the Permanent Multipurpose Module, Bigelow Expandable Activity Module, and Quest Joint Airlock. Hatches between the U.S. and Russian segments remain open.

An additional precautionary measure of sheltering the crew was executed for two passes through or near the vicinity of the debris cloud. The crew members made their way into their spacecraft shortly before 2 a.m. EST and remained there until about 4 a.m. The space station is passing through or near the cloud every 90 minutes, but the need to shelter for only the second and third passes of the event was based on a risk assessment made by the debris office and ballistics specialists at NASA’s Johnson Space Center in Houston.

For updates about the International Space Station, its research, and its crew, visit:

<https://www.nasa.gov/station>

# (November 6) United States Loses First Global Space War to Russians What is Space War? How to Fight and Win the Next Space War?

by **Mr. Paul Szymanski** (Outer Space Warfare Noted Author and Speaker, Space Strategies Center; Space Control Consultant) (Screenshots Only)

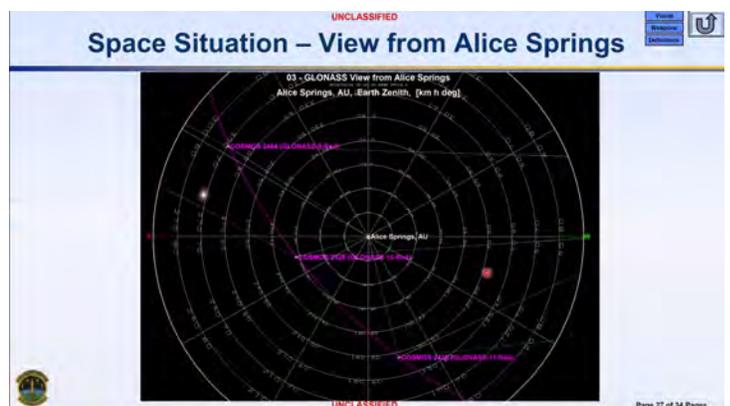
<https://engage.aiaa.org/losangeles-lasvegas/viewdocument/2021-november-6-united-states-los>



Mr. Paul Szymanski reviewing the history of Space Warfare and explaining the definition, basics, and how to win a space war.



The speaker explaining the unique characteristics of Space Systems, and also the timeline of the Ukraine situation in 2014, which led to a space war between Russia and U.S.

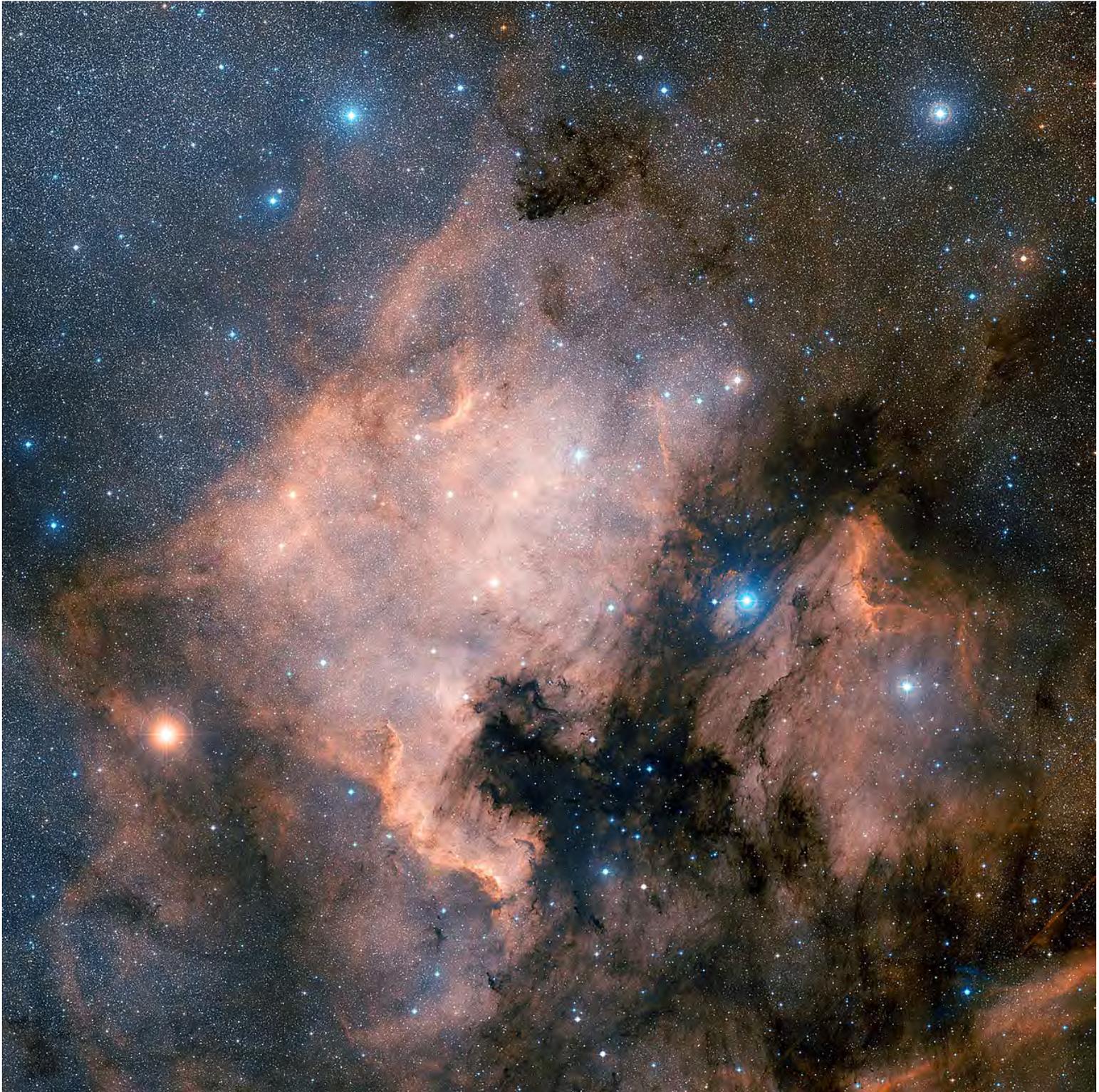


The speaker explaining the situations of the GPS satellites and other attacks during the 2014 Ukraine crisis, pointing out the importance of the space situation awareness.

## Daffy Duck

by Dr. David H. Levy, Comet and Asteroid Hunter, Co-Discoverer, Shoemaker-Levy 9 (2021 December article)

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*This picture shows The North America Nebula, with what the author think is the Daffy Duck structure at the top center. Photograph from Hubble Space Telescope, STScI.*

## Daffy Duck

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Agreed, this seems like an awfully daffy title for an astronomy article. But there is method to the madness, and there is a story. During the late summer of 2019 there was a star party in southeast Arizona that featured a dark sky and five perfect back-to-back nights. As I spent hour after hour hunting for comets, I came across the sprawling North America Nebula in the northern sky constellation of Cygnus the swan. But this time something different appeared. It was a strange structure, the outline of a dark nebula bordered by a slightly brighter cloud. The whole feature was rather subtle, so that sometimes it was there, and then it faded so that sometimes it wasn't. I spent some time trying to determine a name for it. It looked like the head of a duck. I couldn't call it the wild duck nebula, as there is a cluster with that name. And Donald Duck is a bit confusing. So how about calling it the Daffy Duck nebula?

Thus, the structure is named after Daffy Duck. It is No. 403 in my catalog of interesting things found during my more than 56 years of comet hunting. I believe it is a small dark construction at the northern tip of the North America Nebula, about where Hudson Bay is not accurately located. It could have been where the Gulf of Mexico is, but that area is virtually impossible to spot visually, even under a dark sky. Like the Horsehead Nebula in Orion, it is very difficult to spot and it is best viewed only in a photograph. The accompanying picture shows it at its top, a little to the left of center. The accompanying photograph was taken using the Hubble Space Telescope. There are more than four hundred other celestial objects that have come my way over the years. Beginning with NGC 1931 which I spotted in January 1966, many of these are already well-known deep sky objects in the night. But a few are interesting groupings of stars, called asterisms, that no one has pointed out before. One of my favorites is a structure of faint stars I call "Wendee's Ring."

These always welcome objects in the sky are fun to observe and they enhance my enjoyment of my hours under the stars. When I can see Daffy Duck, it reminds me of the happy hours I spent as a child at Beaver Lake, an artificial pond near the top of Mt. Royal in Montreal, that hosts dozens of mallard ducks. On clear, moonless nights now, I offer a cosmic hello to Daffy Duck and the many objects in the night sky I have come to treasure as good friends.

## ASTRA REACHES ORBIT

by Astra Space, Inc., 2021 November 22 (with permission) <https://astra.com/news/astra-reaches-orbit/>



*United States Space Force test payload delivered to precise orbit in under ten minutes*

Alameda, CA. November 22, 2021. Astra Space, Inc. (“Astra”) (Nasdaq: ASTR), successfully completed its first commercial orbital launch for the United States Space Force late Friday night, November 19, 2021, PST. The launch, STP-27AD2, was conducted from Astra’s Kodiak Spaceport, located at the Pacific Spaceport Complex in Kodiak, Alaska.

Astra’s launch system successfully demonstrated the orbital placement of a test payload to an inclination of 86.0 degrees at an altitude of 500 km. The payload achieved an orbital velocity of 7.61 kilometers per second in 8 minutes and 47 seconds.

“Reaching orbit is a historic milestone for Astra,” said Chris Kemp, Founder, Chairman and CEO of Astra. “We can now focus on delivering for our customers and scaling up rocket production and launch cadence.”

The United States Space Force contracted this launch through a Defense Innovation Unit Other Transaction Agreement.

Astra was founded in 2016 to launch a new generation of space services enabled by large constellations of small satellites in Low Earth Orbit. The team set out to design a rocket that could be mass produced like an automobile, and a launch system that could deliver payloads into orbit from spaceports everywhere, inspired by the opportunity to provide daily access to space. In just five years, Astra successfully “learned its way” to orbit, launch by launch, increasing capabilities, decreasing costs, and increasing operational efficiencies with each iteration.

“We owe this success to our incredible team and the culture we’ve built at Astra.” said Adam London, Co-Founder and CTO of Astra. “I’m humbled by their courage and commitment to keep building, launching, learning, and iterating until we succeeded.”

## ASTRA REACHES ORBIT

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### About Astra

Astra's mission is to improve life on Earth from space by creating a healthier and more connected planet. Today, Astra offers the lowest cost-per-launch dedicated orbital launch service of any operational launch provider in the world. Astra delivered its first commercial payload into Earth orbit in 2021, making it the fastest company in history to reach this milestone, just five years after it was founded in 2016. Astra (NASDAQ: ASTR) was the first space launch company to be publicly traded on Nasdaq. Visit [astra.com](https://astra.com) to learn more about Astra.

### Safe Harbor Statement

Certain statements made in this press release are "forward-looking statements". Forward-looking statements may be identified by the use of words such as "anticipate", "believe", "expect", "estimate", "plan", "outlook", and "project" and other similar expressions that predict or indicate future events or trends or that are not statements of historical matters. These forward-looking statements reflect the current analysis of existing information and are subject to various risks and uncertainties, including Astra's failure to meet the projected launch targets. As a result, caution must be exercised in relying on forward-looking statements. Due to known and unknown risks, actual results may differ materially from Astra's expectations or projections including the following factors, among others: projected development and launch targets, including as a result of the decisions of governmental authorities or other third parties not within our control, weather and other suboptimal conditions that may make it difficult to perform a launch attempt; (ii) changes in applicable laws or regulations; (iii) the ability of Astra to meet its financial and strategic goals, due to, among other things, competition; (iv) the ability of Astra to pursue a growth strategy and manage growth profitability; (v) the possibility that Astra may be adversely affected by other economic, business, and/or competitive factors; (vi) the effect of the COVID-19 pandemic on Astra, (vii) the ability to manage its cash outflows during its pre-revenue business operations and (viii) other risks and uncertainties discussed from time to time in other reports and other public filings with the Securities and Exchange Commission by Astra.

When we use the phrase "commercial orbital launch," we mean a launch conducted under a FAA Commercial Launch License.

## The Station Crew Welcomed Four New Members

by Norah Moran, NASA, 2021 November 11

<https://blogs.nasa.gov/commercialcrew/2021/11/11/the-station-crew-welcomed-four-new-members/>



*The Expedition 66 crew poses for a photo after SpaceX Crew-3's arrival to station. Credit: NASA TV*

Running more than 30 minutes ahead of schedule, the SpaceX Crew-3 astronauts docked to the International Space Station at 6:32 p.m. EST Thursday, Nov. 11, less than 24 hours after launching from the Kennedy Space Center in Florida. NASA astronauts Raja Chari, Tom Marshburn, Kayla Barron, and ESA (European Space Agency) astronaut Matthias Maurer opened the hatch of their Crew Dragon spacecraft Endurance at 8:25 p.m. and participated in a welcome ceremony with their new Expedition 66 crewmates at 9 p.m.

On board to welcome them were fellow astronaut Mark Vande Hei, Expedition 66 Commander Anton Shkaplerov and Flight Engineer Pyotr Dubrov of Roscosmos. Joining the welcome ceremony from Earth were Kathy Lueders, NASA associate administrator for Space Operations, NASA and Josef Aschbacher, ESA director-general.

The newest crew to the microgravity laboratory is the agency's third crew rotation mission with SpaceX and will remain on board until April 2022 as a part of Expedition 66.

More details about the mission and NASA's commercial crew program can be found by following the [commercial crew blog](#), [@commercial crew](#) and [commercial crew on Facebook](#).

## NASA Assigns Astronaut Jessica Watkins to NASA's SpaceX Crew-4 Mission

by NASA, 2021 November 16

<https://www.nasa.gov/press-release/nasa-assigns-astronaut-jessica-watkins-to-nasa-s-spacex-crew-4-mission>



NASA astronaut Jessica Watkins is scheduled to fly to space for the first time as part of NASA's SpaceX Crew-4 mission launching to the International Space Station. Credits: NASA/Bill Ingalls

NASA has assigned astronaut Jessica Watkins to serve as a mission specialist on the agency's upcoming SpaceX Crew-4 mission, the fourth crew rotation flight of the Crew Dragon spacecraft to the International Space Station.

This will be Watkins' first trip to space following her selection as an astronaut in 2017. Watkins joins NASA astronauts Kjell Lindgren and Robert Hines, as well as ESA (European Space Agency) astronaut Samantha Cristoforetti, as a crew member for the Crew-4 mission

NASA previously announced the assignments of Lindgren and Hines as spacecraft commander and pilot, respectively, in February, and ESA announced Cristoforetti as a mission specialist for the mission in May

Crew-4 is scheduled to launch in April 2022 on a SpaceX Falcon 9 rocket from Launch Complex 39A at NASA's Kennedy Space Center in Florida for a six-month science mission aboard the microgravity laboratory

Watkins was born in Gaithersburg, Maryland, and considers Lafayette, Colorado, her hometown. She earned a bachelor's degree in geological and environmental sciences from Stanford University and a doctorate in geology from the University of California, Los Angeles. Dr. Watkins conducted her graduate research on the emplacement mechanisms of large landslides on Mars and Earth. She began her career at NASA as an intern and has worked at the agency's Ames Research Center in California and NASA's Jet Propulsion Laboratory in Southern California. At the time of her astronaut selection, Watkins was a postdoctoral fellow in the Division of Geological and Planetary Sciences at the California Institute of Technology, where she collaborated as a member of the Science Team for the Mars Science Laboratory rover, Curiosity.

For more than 21 years, humans have lived and worked continuously aboard the International Space Station in low-Earth Orbit, advancing scientific knowledge, demonstrating new technologies, and making research breakthroughs not possible on Earth.

Through the Commercial Crew Program and broader commercial efforts, NASA is working with private industry to develop human space transportation services and a robust low-Earth orbit economy that enables the agency to focus on building spacecraft and rockets for deep space missions to the Moon and Mars.

Follow Watkins on Instagram throughout her mission and get the latest space station crew news, images and features on Instagram, Facebook, and Twitter.

## Testing Confirms Webb Telescope on Track for Targeted Dec. 22 Launch

by Alise Fisher, NASA, 2021 November 24

<https://blogs.nasa.gov/webb/2021/11/24/testing-confirms-webb-telescope-on-track-for-targeted-dec-22-launch/>



Engineering teams have completed additional testing confirming NASA's James Webb Space Telescope is ready for flight, and launch preparations are resuming toward Webb's target launch date of Wednesday, Dec. 22, at 7:20 a.m. EST.

Additional testing was conducted this week to ensure the observatory's health following an incident that occurred when the release of a clamp band caused a vibration throughout the observatory.

On Wednesday, Nov. 24, engineering teams completed these tests, and a NASA-led anomaly review board concluded no observatory components were damaged in the incident. A "consent to fuel" review was held, and NASA gave approval to begin fueling the observatory. Fueling operations will begin Thursday, Nov. 25, and will take about 10 days.

The Webb Space Telescope is an international partnership with the European and Canadian space agencies. It will explore every phase of cosmic history – from within our solar system to the most distant observable galaxies in the early universe, and everything in between. Webb will reveal new and unexpected discoveries, and help humanity understand the origins of the universe and our place in it.

**(November 17) AIAA LA-LV Aero Alumni Meeting** *(Screenshots Only)*

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Attendees getting together on Zoom remotely (top row) and also in a local restaurant (bottom row), sharing thoughts on interesting topics like surging cases of COVID-19, genetics/double helix, Issac Asimov, and some other stories and news, as well book-reading.



Attendees and the waitress saying hello to each other, while continuing the fun chatting on several topics.

## Cygnus Departs Station Ending Cargo Mission

by Mark Garcia, NASA, (2021 November 20)

<https://blogs.nasa.gov/spacestation/2021/11/20/cygnus-departs-station-ending-cargo-mission/>



*The Northrop Grumman Cygnus space freighter is in the grip of the Canadarm2 robotic arm moments before its release above the South Pacific Ocean. Credit: NASA TV*

At 11:01 a.m. EST, flight controllers on the ground sent commands to release the Northrop Grumman Cygnus spacecraft from the Canadarm2 robotic arm after earlier detaching Cygnus from the Earth-facing port of the Unity module. At the time of release, the station was flying about 260 miles over the South Pacific Ocean.

The Cygnus spacecraft successfully departed the [International Space Station](#) more than three months after arriving at the space station to deliver about 8,000 pounds of [scientific investigations](#) and supplies to the orbiting laboratory.

After departure, the [Kentucky Re-Entry Probe Experiment \(KREPE\)](#) stowed inside Cygnus will take measurements to demonstrate a thermal protection system for spacecraft and their contents during re-entry in Earth's atmosphere, which can be difficult to replicate in ground simulations.

Cygnus will deorbit on Wednesday, Dec. 15, following a deorbit engine firing to set up a destructive re-entry in which the spacecraft, filled with waste the space station crew packed in the spacecraft, will burn up in Earth's atmosphere.

Cygnus [arrived](#) at the space station Aug. 12, following a launch two days prior on Northrop Grumman's Antares rocket from NASA's Wallops Flight Facility on Wallops Island, Virginia. It was the company's 16th commercial resupply services mission to the space station for NASA. Northrop Grumman named the spacecraft after NASA astronaut [Ellison Onizuka](#), the first Asian American astronaut.

For departure coverage and more information about the mission, visit: <https://blogs.nasa.gov/spacestation/>. Get space station news, images and features via social media at: [@space station](#) and [@ISS Research](#) on Twitter, as well as the [ISS Facebook](#) and [ISS Instagram](#) accounts.

## Cygnus Spacecraft

It's impossible to bring space closer. Until it's not.

by Northrop Grumman Corporation <https://www.northropgrumman.com/space/cygnus-spacecraft/>



### Why is Cygnus Unique?

The Cygnus system is a flight proven design incorporating elements drawn from Northrop Grumman and its partners' existing, flight-proven spacecraft technologies. Cygnus consists of a service module and a pressurized cargo module. The Cygnus spacecraft is used to carry crew supplies, spare equipment and scientific experiments to the space station. The service module incorporates advanced avionics developed by Northrop Grumman and guidance and navigation components that allow for fully autonomous rendezvous with the space station. The avionics design fully meets all of the demanding NASA safety requirements imposed on human-rated vehicles. The pressurized cargo module is manufactured by Thales Alenia Space specifically for Cygnus.



# Cygnus Spacecraft

It's impossible to bring space closer. Until it's not.

## *To the ISS and Beyond*

### *Cygnus Pioneers a New Economy in Low-Earth Orbit*

Currently, Northrop Grumman uses Cygnus to perform International Space Station resupply flights under the second Commercial Resupply Services (CRS) contract. Beginning in 2014, Cygnus has carried more than 70,000 pounds (31,500 kg) of critical cargo to the station under the first CRS-1 contract. In November 2019, the company flew the first CRS-2 mission, NG-12, and will carry out a minimum of five additional missions under this contract.

The Cygnus vehicle provides a number of advanced capabilities during these cargo resupply missions. The spacecraft has already demonstrated a number of these, including the launch of cube satellites from external deployers, the delivery of live rodents to the station, the ability to act as laboratory space while docked to the station, boosting the station's orbit and flying in orbit separately from the station for more than one year.

# TO THE ISS AND BEYOND

## Cygnus Pioneers a New Economy in Low Earth Orbit

Since 2013 our Cygnus™ spacecraft has evolved to deliver innovative capabilities for the International Space Station (ISS) and commercial partners. Each advanced capability expands potential uses for Cygnus, for the ISS, cislunar orbit, and beyond.

### 2013

Cygnus launches aboard an Antares™ rocket, demonstrating commercial cargo capabilities during its maiden flight.

### 2014

Cygnus conducts its first commercial cargo resupply mission to the station.

### 2015

The Enhanced Cygnus sets a record for most cargo delivered to the ISS.

### 2017

Cygnus acts as an extension of the space station by supporting experiments inside the cargo module while docked to the orbiting laboratory.

### Today and Beyond

Cygnus continues to support commercial spaceflight during phase two of its resupply mission through the deployment of CubeSats and future demonstration of long-duration flight through space after departing the ISS. The use of Cygnus for cislunar exploration is the next step in its evolution to support deep space missions.

**NORTHROP GRUMMAN**

Cygnus ISS Infographic (2020): To the ISS and Beyond

## Cygnus Spacecraft

It's impossible to bring space closer. Until it's not.

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*Cygnus has the foundation for vehicles to enable the first woman, and next man, to walk on the Moon*



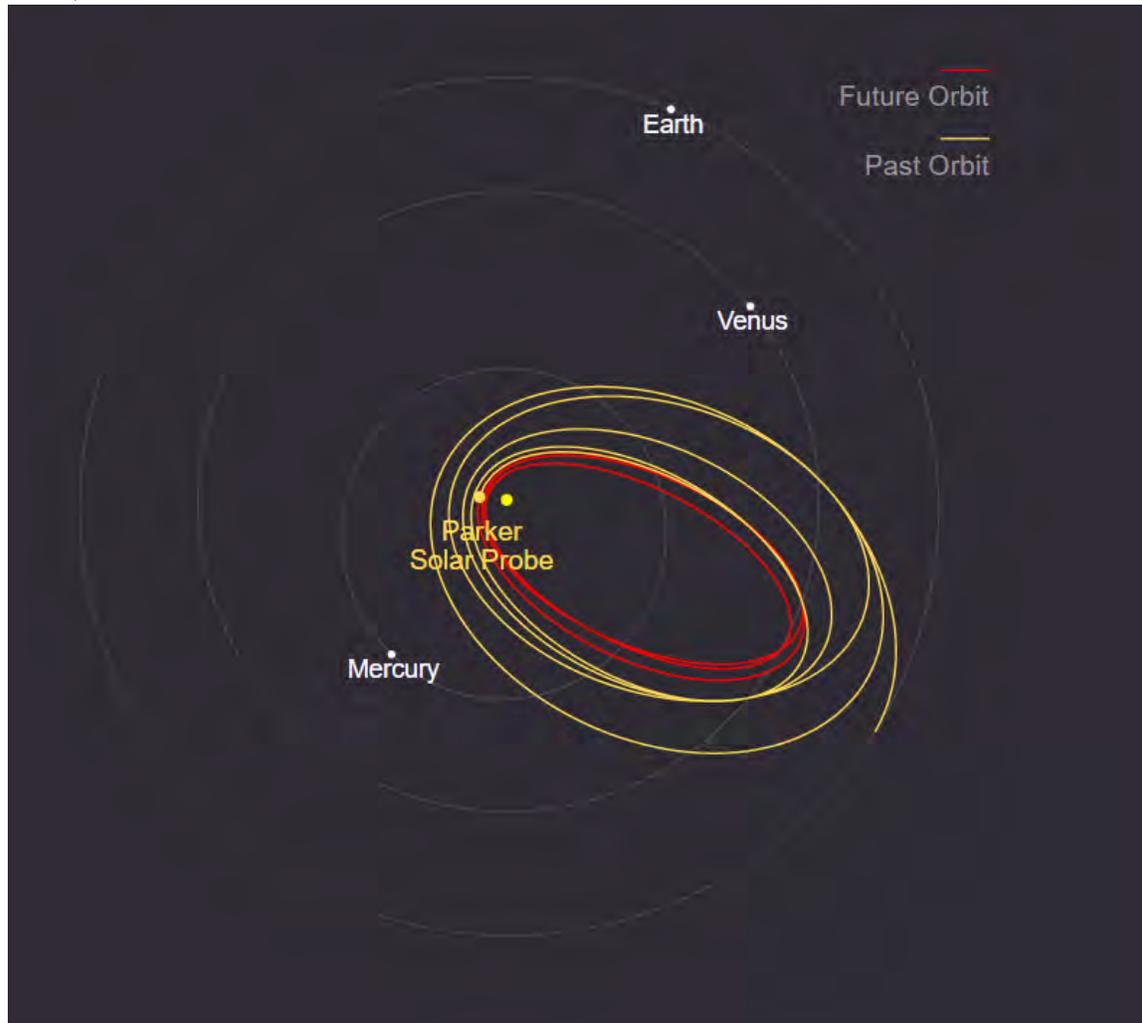
<https://www.youtube.com/watch?v=B3w6S7i1ANs&t=9s>

## Parker Solar Probe Completes a Record-Setting Swing by the Sun

by Miles Hatfield, NASA (2021 November 24)

<https://blogs.nasa.gov/parkersolarprobe/2021/11/24/parker-solar-probe-completes-a-record-setting-swing-by-the-sun/>

Blazing along at space-record speeds that would get it from Earth to the Moon in under an hour, NASA's Parker Solar Probe completed its 10th close approach to the Sun on Nov. 21, coming within 5.3 million miles (8.5 million kilometers) of the solar surface.



*Parker Solar Probe is in the 10th of 24 planned, progressively closer orbits around the Sun. The spacecraft, built and operated at the Johns Hopkins Applied Physics Laboratory in Laurel, Maryland, launched on Aug. 12, 2018. Credit: NASA/Johns Hopkins APL*

The close approach (known as perihelion), also at a record distance, occurred at 4:25 a.m. EST (8:25 UTC), with Parker Solar Probe moving 364,660 miles per hour (586,864 kilometers per hour). The milestone also marked the midway point in the mission's 10th solar encounter, which began Nov. 16 and continues through Nov. 26.

The spacecraft entered the encounter in good health, with all systems operating normally. Parker Solar Probe is scheduled to check back in with mission operators at the Johns Hopkins Applied Physics Laboratory in Laurel, Maryland – where it was also designed and built – on Nov 24.

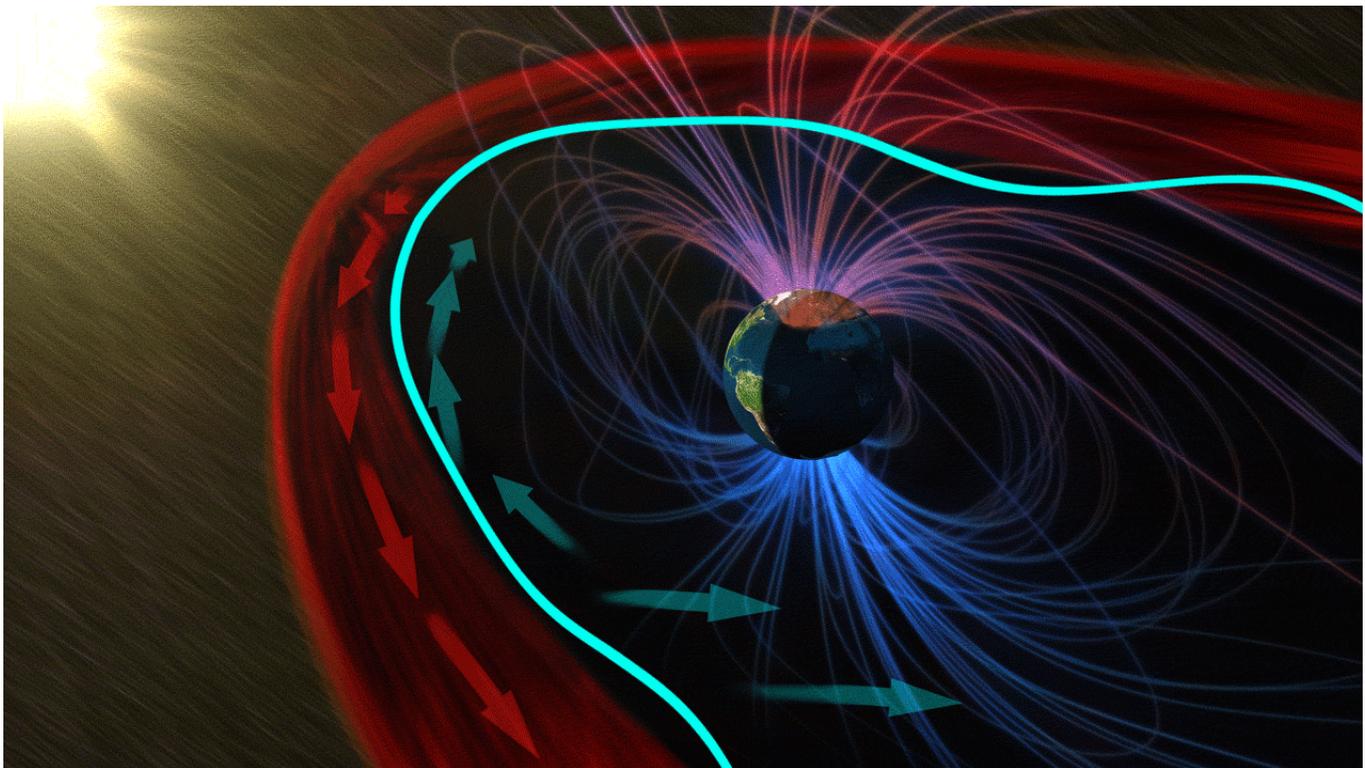
The spacecraft will transmit science data from the encounter – largely covering the properties and structure of the solar wind as well as the dust environment near the Sun – back to Earth from Dec. 23-Jan. 9.

## With NASA Data, Researchers Find Standing Waves at Edge of Earth's Magnetic Bubble *(NASA THEMIS Mission & Space Weather)*. by NASA, 2021 October 6

<https://www.nasa.gov/feature/goddard/2021/themis-researchers-find-standing-waves-at-edge-of-earth-magnetic-bubble>

Earth sails the solar system in a ship of its own making: the magnetosphere, the magnetic field that envelops and protects our planet. The celestial sea we find ourselves in is filled with charged particles flowing from the Sun, known as the solar wind. Just as ocean waves follow the wind, scientists expected that waves traveling along the magnetosphere should ripple in the direction of the solar wind. But a new study reveals some waves do just the opposite.

Studying these magnetospheric waves, which transport energy, helps scientists understand the complicated ways that solar activity plays out in the space around Earth. Changing conditions in space driven by the Sun are known as [space weather](#). That weather can impact our technology from communications satellites in orbit to power lines on the ground. "Understanding the boundaries of any system is a key problem," said Martin Archer, a space physicist at Imperial College London who led the new study, published today in [Nature Communications](#). "That's how stuff gets in: energy, momentum, matter."



<https://www.nasa.gov/sites/default/files/thumbnails/image/magnetopause-waves.gif>

An animated illustration of magnetospheric waves, in light blue. At the front of the magnetosphere, these waves appear to be still. Credits: Martin Archer/Emmanuel Masongsong/NASA

Archer focuses on surface waves, meaning waves that require a boundary — in this case, the edge of the magnetosphere — to travel along. Previously, he and his colleagues established [this boundary vibrates like a drum](#). When a strong burst of solar wind beats against the magnetosphere, waves race towards Earth's magnetic poles and get reflected back.

The latest work considers the waves that form across the entire surface of the magnetosphere, using a combination of models and observations from NASA's [THEMIS](#) mission, Time History of Events and Macroscale Interactions during Substorms.

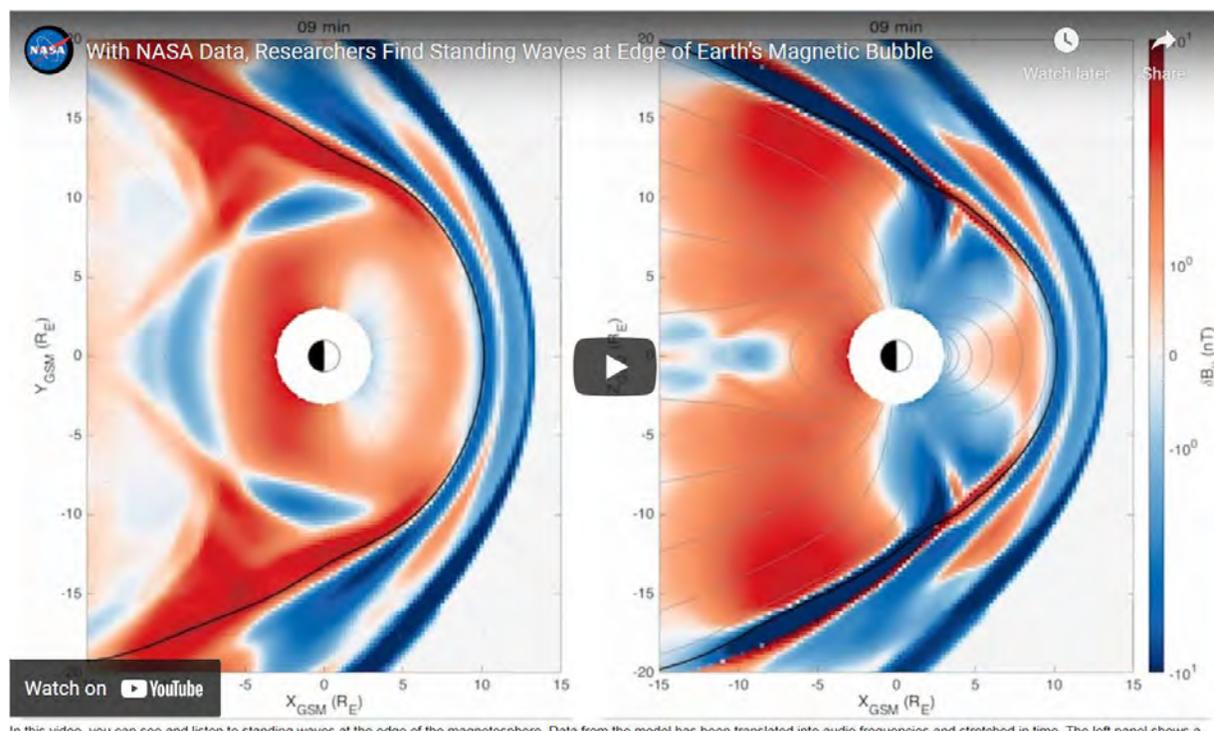
## With NASA Data, Researchers Find Standing Waves at Edge of Earth's Magnetic Bubble (NASA THEMIS Mission & Space Weather)

The researchers found when solar wind pulses strike, the waves that form not only race back and forth between Earth's magnetic poles and the front of the magnetosphere, but also travel against the solar wind. Archer likened these two kinds of movement to crossing a river: A boat can go from one riverbank to the other (traveling towards the poles) and upstream (against the solar wind). At the front of the magnetosphere, these waves appear to stand still.

The THEMIS satellites' observations from within the magnetosphere first hinted some waves might be traveling against the solar wind. The researchers used models to illustrate how the energy of the wind coming from the Sun and that of the waves going against it could cancel each other out. It's similar to what happens if you try walking up a downwards escalator. "It's going to look like you're not moving at all, even though you're putting in loads of effort," Archer said.

These standing waves can persist longer than those that travel with the solar wind. That means they're around longer to accelerate particles in near-Earth space, leading to potential impacts in the radiation belts, aurora, or ionosphere. Archer expects standing waves may occur elsewhere in the universe, from the magnetospheres of other planets to the peripheries of black holes. Studying the waves close to home can help scientists understand such distant boundaries.

By translating the wave models and data into the audible range, we can listen to the sound of these curious waves.



<https://www.youtube.com/watch?v=4A1k8Topohk>

In this video, you can see and listen to standing waves at the edge of the magnetosphere. Data from the model has been translated into audio frequencies and stretched in time. The left panel shows a view looking down on Earth's north pole. The right panel presents a view that slices through Earth's magnetosphere, down the north and south poles. Red shows where the magnetic field grows stronger, while blue shows where it weakens. You first hear higher-frequency waves that are quickly replaced by a lower pitch — the standing waves that persist longer at the edge of the magnetosphere. Credits: Martin Archer/CCMC/NASA

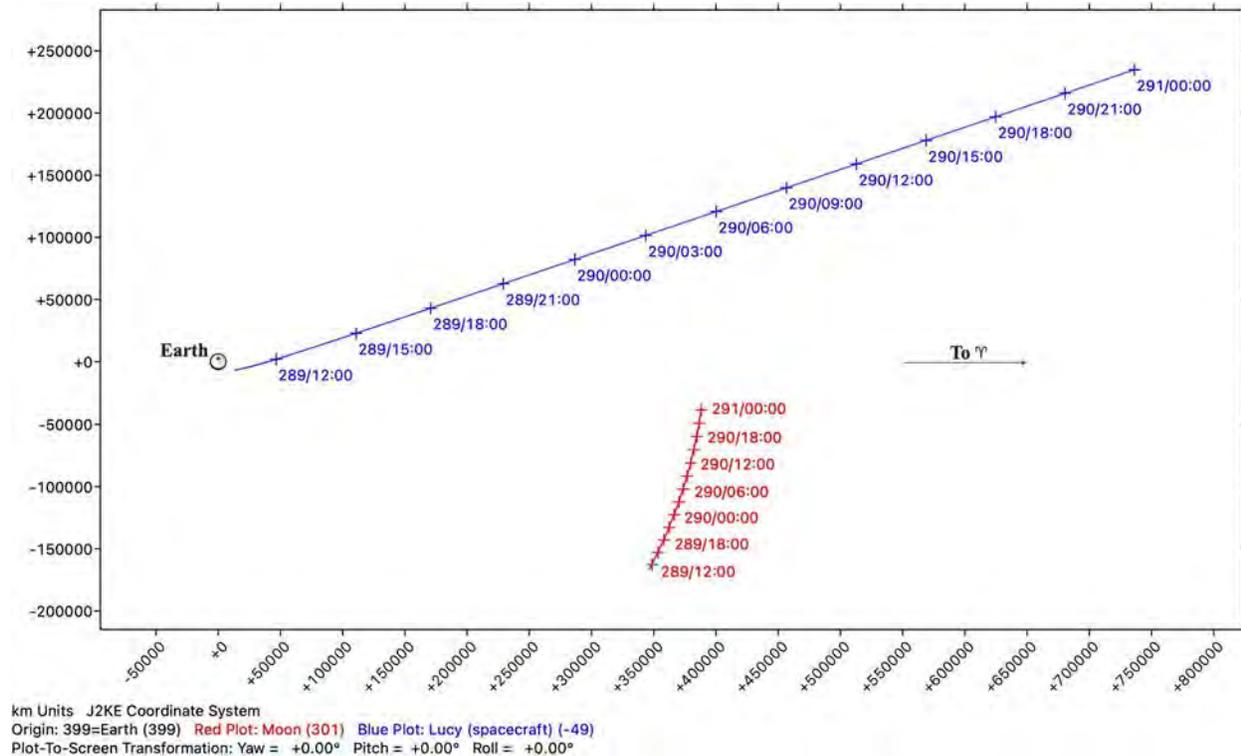
[Download this video in HD formats from NASA Goddard's Scientific Visualization Studio](#)

## Lucy's Earth Departure

by Mr. Daniel R. Adamo, AIAA Associate Fellow, Astrodynamics Consultant

2021 November 7

*Lucy*, the first spacecraft targeting visits to Jupiter's Trojan asteroids, was successfully launched on 16 October 2021.<sup>1</sup> The first leg of *Lucy*'s 12-year primary mission entails orbiting the Sun never very far from Earth for a year.<sup>2</sup> Earth-centered motion of *Lucy* and the Moon during the mission's first two days is illustrated in Figure 1.<sup>3</sup>



**Figure 1. Geocentric inertial motion of *Lucy* (blue) and the Moon (red) projected onto the ecliptic plane are plotted during the spacecraft's Earth departure. Time ticks ("+" markers) appear at 3-hour intervals and are annotated with 16-18 October 2021 UTC in "day-of-year/hour:minute" format. The shaded area of Earth's surface is its nightside, and the embedded small circle is at 80° N Latitude.**

By inferring the Sun's direction from Earth's shaded nightside in Figure 1, it is evident *Lucy*'s initial departure for interplanetary space is radially outward with respect to Earth's nearly circular heliocentric orbit.<sup>4</sup> This radial departure dictates *Lucy*'s initial heliocentric orbit has a period very nearly that of Earth's. Consequently, *Lucy* will return to Earth's vicinity from the Sun's direction for a gravity assist one year after launch.

A similar Earth gravity assist encounter could have been targeted by initially departing Earth *toward* the Sun, but communications with *Lucy* would have been more difficult in the up-Sun direction during critical events, such as solar array deployments, immediately after launch. The "radial outward departure from Earth" strategy likely proved its worth when one of *Lucy*'s two

<sup>1</sup> Reference <http://lucy.swri.edu> (accessed 6 November 2021).

<sup>2</sup> Reference <http://lucy.swri.edu/mission/Tour.html> (accessed 6 November 2021).

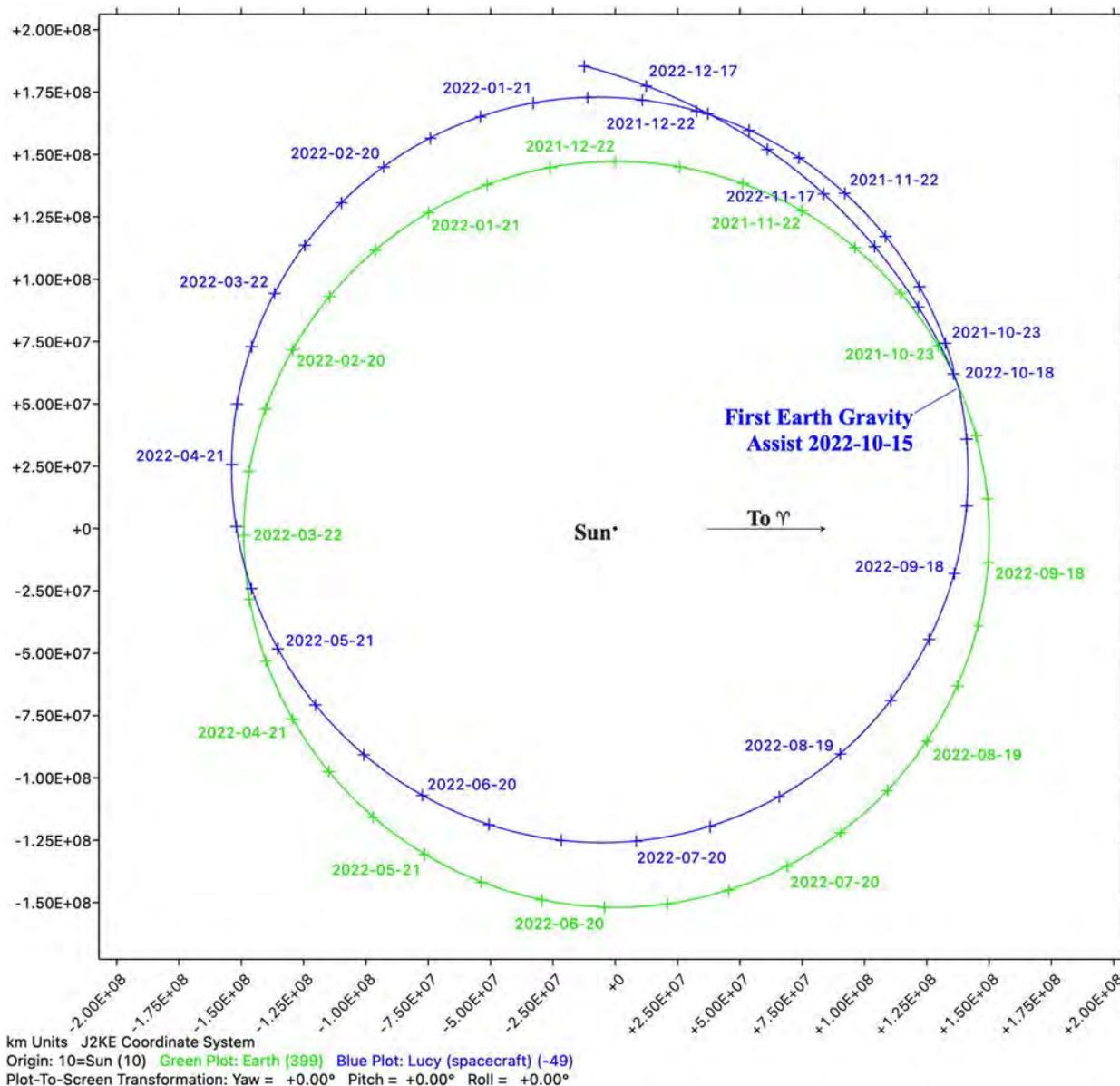
<sup>3</sup> All plotted *Lucy* trajectory data are obtained from <https://ssd.jpl.nasa.gov/horizons/> (accessed 7 November 2021).

<sup>4</sup> Indeed, this plot ends with *Lucy* about halfway to the second Sun-Earth Lagrange point (SEL2) located 1.5 million km outside Earth's heliocentric orbit.

### Lucy's Earth Departure

solar arrays failed to fully deploy and latch. Troubleshooting of this anomaly is ongoing as of this writing, but it does not appear to compromise mission success.<sup>5</sup>

Figure 2 illustrates heliocentric motion of *Lucy* and Earth during the interval from launch until shortly after the first Earth gravity assist on 15 October 2022. Thereafter, *Lucy* will be in a heliocentric orbit whose period is about 2 years. This trajectory produces a second Earth gravity assist on 12 December 2024 resulting in *Lucy's* first Trojan asteroid encounters in 2027.

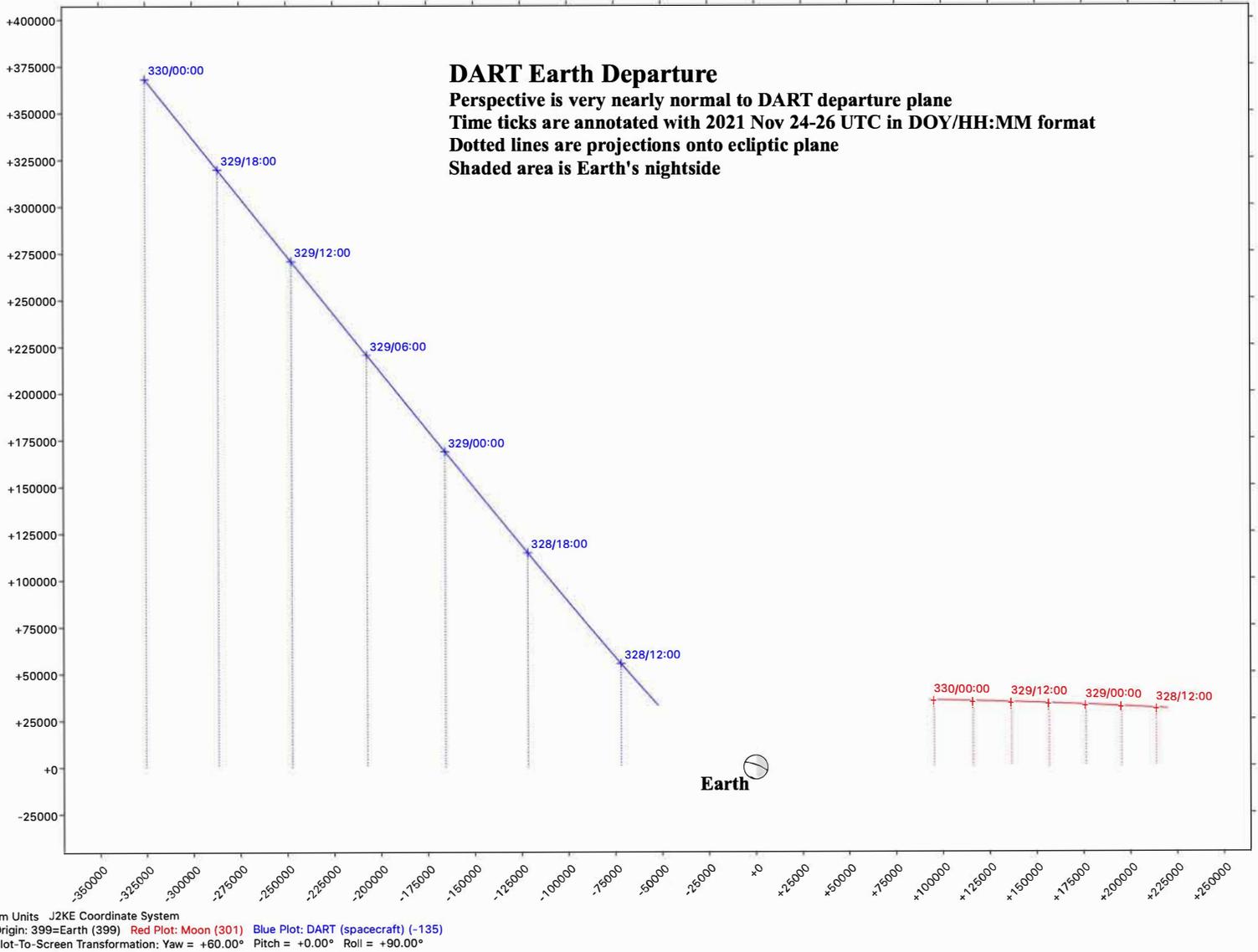


**Figure 2. Heliocentric inertial motion of *Lucy* (blue) and Earth (green) projected onto the ecliptic plane is plotted during the mission's first 14 months after launch. Time ticks ("+" markers) appear at 10-day intervals and are annotated in "year-month-day" format.**

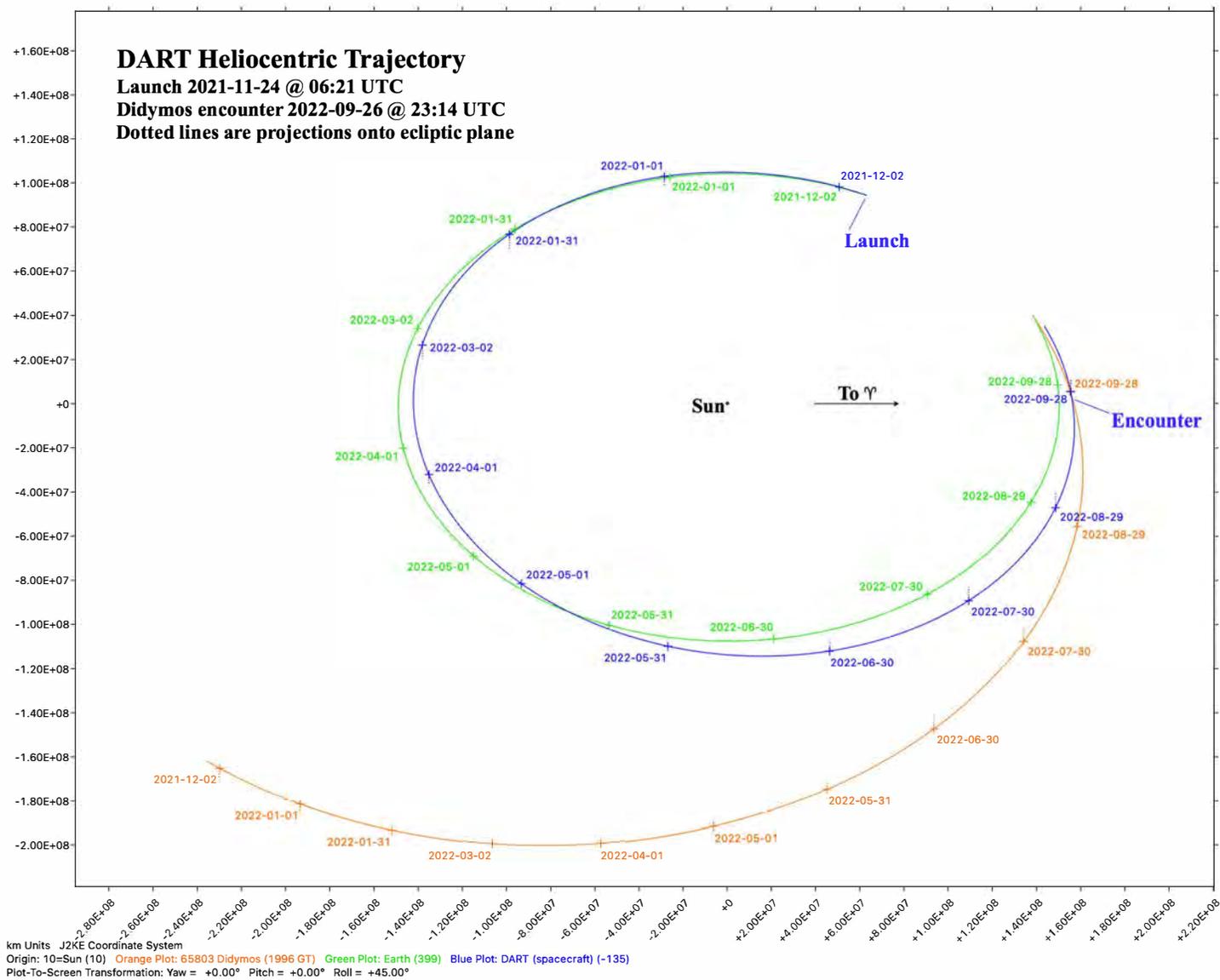
<sup>5</sup> Reference <https://blogs.nasa.gov/lucy/2021/10/19/nasa-team-remains-focused-on-lucys-solar-arrays/> (accessed 6 November 2021).

# DART Trajectory Plots

by Mr. Daniel R. Adamo, AIAA Associate Fellow, Astrodynamics Consultant  
2021 November 26



# DART Trajectory Plots



# Clean Energy from Space: Has Space Solar Power's Time Come?

Al Globus, AIAA Space Settlement Technical Committee, and Dale Skran, National Space Society

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December 2021

Change that promises vast quantities of clean, nearly carbon-free power is coming. Specifically, Space Solar Power (SSP) is coming. For the purpose of this paper, SSP refers to solar energy gathered in space, beamed to the ground, and converted to electricity. SSP has been studied for decades and found to be technologically feasible but thus far not competitive financially. In the past, projected costs, particularly launch and manufacture, were too high to be commercially viable. However, that situation is changing.

## Recent SSP Activity

SSP launch and manufacturing costs are dropping dramatically and driving a new, powerful wave of SSP interest and activity. These include:

1. In September 2021, the UK Department for Business, Energy and Industrial Strategy (BEIS) received a very positive report ([Space based solar power: de-risking the pathway to net zero](#)) commissioned from the independent Frazer-Nash Consultancy suggesting that:
  - a. SSP is technically feasible.
  - b. SSP is environmentally sound and supports Net Zero<sup>1</sup> pathways.
  - c. SSP is affordable, with a competitive projected Levelized Cost of Electricity<sup>2</sup>.
  - d. SSP can supply baseload<sup>3</sup> power. Baseload power is continuous 24x7 power, as opposed to the intermittent power of ground solar and wind. Combining SSP baseload power with intermittent ground sources is a powerful recipe for a large and resilient power supply.
  - e. SSP can provide perhaps 15% of UK (United Kingdom) electricity by 2042.
  - f. Development of SSP would bring substantial economic benefits to the UK.

2. This led to the establishment of the UK based [Space Energy Initiative](#) created to develop SSP in conjunction with the international community. An impressive list of well known companies, universities, and governments are members of the initiative.
3. In August 2021 the [Innovation Frontier Project](#), part of the [Progressive Policy Institute](#), published Daniel Oberhaus' [Space Solar Power: An Extraterrestrial Energy Resource for the U.S.](#) From the report: "In this paper, we make the case for space-based solar power (SSP) megaprojects as relatively low-cost, scalable, renewable, and always-on power source for on- and off-world applications. Although SSP is a space-based energy asset, it has the potential to rapidly accelerate decarbonization on Earth while also fulfilling space exploration priorities."
4. In August 2021 the [Beyond Earth Institute](#) published [Catching the Sun: A National Strategy for Space Solar Power](#), and also published a draft [Presidential Policy Directive](#) on the same topic. From the executive summary: "Space Solar Power can fulfill the promise of clean, safe, renewable, affordable energy reliably delivered where and when it is needed. Space Solar Power can power the world, and power worlds beyond, while moving our civilization beyond the fossil fuel age."
5. [Caltech recently announced that they have received more than \\$100M](#) in private donations since 2013 to develop SSP technology. There is a large group of Caltech professors, staff, students and postdocs continuing this work. Space flights to test some of this technology have been flown and more are expected soon.
6. The [National Space Society \(NSS\)](#), which has promoted SSP for decades, has a [renewed program specifically aimed at SSP promotion](#). Past NSS SSP position papers include:
  - a. [A Public/Private COTS-Type Program to Develop Space Solar Power](#) January 2020
  - b. [Space Solar Power: Enabling a Green Future with Economic Growth](#) July 2019
  - c. [How Space Technology Benefits the Earth](#) July 2019
  - d. [Space Solar Power and Feed-In Tariffs](#) Nov 2013
  - e. [Space Solar Power](#) Oct 2007
7. In 2020 the Alliance for Space Development made [SSP one of its four legislative objectives](#) starting in 2020 and continuing to the present. The alliance is an

organization of 15 nonprofits dedicated to promoting space development and space settlement in Congress and the Administration.

8. The Aerospace Corporation's Center for Space Policy and Strategy produced a paper, [Space-Based Solar Power: A Near-Term Investment Decision](#), noting the progress that has been made recently and suggesting that substantial, sustained SSP investment should be under serious consideration.
9. The IEEE Journal of Radio Frequency Identification is planning a special issue on SSP in September 2022.
10. ESA (European Space Agency) is planning an international workshop entitled Space-Based Solar Power for Net Zero 2050.
11. The Department of Defense is requesting over \$67M for fiscal 2022 SSP development. Projects include power beaming and the development of 'sandwich' modules that take in sunlight on one side and emit microwaves on the other<sup>4</sup>.
12. The U.S. Air Force's X-37B space plane was launched in May 2020. It carried and tested a sandwich module developed by DoD's Naval Research Laboratory in the PRAM Mission<sup>5</sup>.
13. China's increasing space development success combined with their SSP work is raising eyebrows. China reportedly plans to begin their SSP program with a small-scale electricity generation test in 2022, followed by megawatt-level power generation in perhaps 2030<sup>6</sup>. Commercial, gigawatt-level power generation from space is targeted for 2050.

China has proven it can operate in space, with a small space station in orbit now and working hardware on the Moon and Mars. If China or someone else masters SSP well ahead of others they will quickly dominate near-Earth and cis-lunar space with huge satellites built to satisfy Earth's and lunar energy needs. As a result, they will gain enormous soft-power benefits from being able to rapidly deliver electricity to third world countries and disaster areas. If China develops SSP, it will greatly increase their geopolitical power on Earth.

#### Why so much interest now?

First, because the dominant costs of SSP, launching and manufacturing, are dropping like a stone, bringing economic viability much closer. Second, awareness that we must migrate our massively carbon-based energy systems to technologies that avoid harming the Earth's environment, particularly the atmosphere. SSP is very clean and can potentially supply vast quantities of carbon-free energy.

## Orders of Magnitude Cost Reduction

There are two arenas that between them dominate SSP costs: launch and manufacture. As we will see, it is reasonable to expect that in the near future the costs of both will be reduced by about two orders of magnitude compared to the Space Shuttle era.

### Launch Cost Reduction

In 2011 the Space Shuttle flew its last flight in the midst of a long era of \$20,000 per kg or more launch costs, primarily on expendable boosters. Today (2021), the cheapest launch vehicle is the partially reusable SpaceX Falcon Heavy with an advertised launch price of around \$1,400 per kg, a reduction of well over an order of magnitude. But this is just the start of the near term cost reductions.

SpaceX has been developing the fully reusable and very large<sup>7</sup> launch vehicles Starship and Super Heavy. Suborbital flight tests have been successful. These vehicles, due to full reusability, large size and other developments, have an estimated launch cost of somewhere around a few hundred dollars per kg, another order of magnitude reduction. While SpaceX frequently misses deadlines they have consistently achieved their performance goals eventually. They build and operate the most successful launch vehicle of our day, the partially reusable Falcon 9, suggesting that SpaceX knows how to build cost-effective rockets.

This suggests it is reasonable, within a few years, to expect a reduction in launch cost of around two orders of magnitude when compared to the Space Shuttle era, the period within which studies found SSP too expensive due to launch costs. But there is more.

### Manufacture Cost Reduction

While launch costs are a major fraction of the economic problem faced by SSP, they are not the largest. Satellites are generally significantly more expensive than their launch. Typical cost of a payload can range from a few thousand to a few hundred thousand dollars per kg<sup>8</sup>. Such high prices reflect that traditional payloads are handcrafted one-of-a-kind systems. One way to significantly reduce costs involves designing and manufacturing large numbers of identical components to amortize production automation and achieve other economies of scale. The problem for SSP, a new source of power, is to get economies of scale when building the first operational powersats<sup>9</sup>.

The communication satellite mega-constellations are leading the way to this step. Each mega-constellation consists of hundreds or even thousands of identical, or nearly identical, spacecraft. These spacecraft can be, and are, mass produced. For even a single constellation the number of satellites is large enough that engineers can get economies of scale. For SpaceX's Starlink, that drives cost to about one percent of the cost of traditional communication satellites<sup>10</sup>. This derives from the typical historical cost of a satellite in Earth orbit of approximately \$100,000 to \$300,000 per kilogram, versus the

cost of a Starlink satellite. A Starlink has a mass of about 275 kg and costs about \$500,000 per satellite—which works out to less than \$2,000 per kilogram. Thus there is a cost reduction of approximately 100-fold. As you may have guessed, there is more.

The SPS-ALPHA (Solar Power Satellite by means of Arbitrarily Large Phased Array)<sup>11</sup> design takes the next step, generating economies of scale in the manufacture of a single, albeit extremely large, satellite. SPS-ALPHA consists of about two million modules<sup>12</sup> of about 16 types, an average of about 125,000 modules per type. This is a sufficient number for economies of scale and learning effects to drop costs. The list of module types changes as the design matures, but for illustrative purposes, a few of these types might be:

1. An adjustable mirror module type that reflects sunlight onto an array of beam generation modules.
2. A beam generator ‘sandwich’ module type that takes sunlight from one side and emits microwaves for a phased array.
3. A simple robot arm type that can work in groups to construct and repair powersats by adding and removing modules.
4. A module type with electric propulsion for station keeping and transferring the finished powersat from a construction site, likely in low Earth orbit, to operations in geosynchronous orbit where a powersat can stay visible at one point in the sky with only brief eclipses near the equinox.

In addition, there are a number of trusses<sup>13</sup> built using the same simple robots or any of a number of space truss systems under development. Building the trusses is likely to be the first step in powersat construction. Using the trusses for structure, modules will be assembled in a space environment designed for robotic construction and repair. The closest analogy is a robotic warehouse where automated robotic forklifts move pallets. This is a much easier task than, say, navigating on the surface of Mars, which is not designed for robotic exploration.

These reductions in cost should make SSP a viable energy source for commercial reasons alone. But, there is more. SSP is approaching economic availability just as there is a desperate need for carbon-free power.

## Protection of Earth’s Atmosphere

Earth’s atmosphere is, by far, our most valuable asset. We are adding CO<sub>2</sub>, CH<sub>4</sub> (carbon dioxide and methane) and other greenhouse gasses to the atmosphere in vast quantities, mostly as a result of energy production. This heats the atmosphere and amounts to a poorly controlled experiment with poorly understood but potentially catastrophic outcomes.

SSP can help reverse this dangerous climate trend by providing very large quantities of energy with minimal emissions of greenhouse gasses. Greenhouse emissions are limited to the launch and ground antenna maintenance. Ground operations are minimal and can employ electric vehicles. Launch greenhouse emissions may be very close to zero depending on the fuel. Many existing and near-term rocket fuels are carbon-based and do, as one might suspect, contribute to SSP's carbon footprint. The most common of carbon based rocket fuel is RP1 but methane is cleaner. A few launch vehicles use hydrogen for fuel and so have close to a zero carbon footprint. Better yet, in the long run all forms of launch pollution can be completely removed from Earth by manufacturing SSP components in space using lunar or asteroidal materials.

Elon Musk has announced his intention to make the methane fueled Starship/SuperHeavy launches net zero by using atmospheric carbon dioxide to manufacture methane, a process he also plans to use on Mars to refuel the Starship for a return to Earth. Additionally, it should be noted that any carbon emissions associated with launch are one-time events, so should be amortized over the lifetime of the SPS being launched.

## Baseload Power

New green energy is needed to eliminate global warming without a massive reduction in lifestyle for the fortunate or forcing the poor to stay that way. Wind and ground solar can provide a significant portion of that energy. However, since wind and ground solar are intermittent they must be combined with baseload power or large amounts of energy storage. This is necessary for intermittent renewables to be part of a reliable power system.

SSP is a particularly attractive option for baseload power as it should:

1. Be available roughly 99.5% of the time from a single satellite and more for multiple satellites. Short outages occasionally happen near equinoxes where geosynchronous satellites are shadowed by the Earth.
2. Have completely predictable and short outages that can be briefly replaced by batteries or other stored power at the ground receiving antenna. Alternatively, multiple powersats can share a number of ground receiving antennas switching between them as needed.
3. Be able to switch receiving antennas very quickly as demand changes.

The ability to provide baseload power with only short and predictable outages makes SSP a good partner for the emerging 'green' electrical grid consisting of production by both intermittent and baseload assets.

## Conclusion and Recommendations

Mass production of SSP modules combined with fully reusable, very large launchers in flight test today are changing the playing field. The potential of a two orders of magnitude cost reduction in the most expensive parts of a spacecraft, launch and manufacture, means the business case for SSP may at long last be closing. Of critical importance is that SSP can provide vast quantities of clean power to help decarbonize civilization. An important detail is that SSP may provide baseload energy to terrestrial grids at an affordable price, making achievement of Net Zero much easier. At its core, this is why there is so much current interest.

The next step is to convert interest into research, development, and—when ready—deployment of SSP. The NSS position paper [A Public/Private COTS-Type Program to Develop Space Solar Power](#), January 2020, calls for immediate new funding for SSP. Additionally, the National Space Society endorses the Defense Department funded SPS research referred to in the [Alliance for Space Development 2021 objectives](#).

SSP can make for a brighter future; we can and must grasp it!

<sup>1</sup> Net Zero refers to removing as many emissions as are added so that there is no increase in carbon.

<sup>2</sup> Levelized Cost of Electricity is a measure of the cost of an energy option equal to lifetime cost of the energy source divided by the total amount of energy produced. This is usually used by investors.

<sup>3</sup> Baseload power is the minimum level of demand on an electrical grid over a span of time, such as one week.

<sup>4</sup> [NRL PRAM Mission: One Year and Still Going](#), 10 June 2021

<sup>5</sup> *ibid*

<sup>6</sup> [China's super heavy rocket to construct space-based solar power station](#) Andrew Jones, SpaceNews, June 28, 2021.

<sup>7</sup> Larger launch vehicles tend to have lower cost of launch per unit mass than smaller vehicles.

<sup>8</sup> John Mankins, personal communication, Summer, 2021

<sup>9</sup> A powersat is an SSP satellite.

<sup>10</sup> John Mankins, verbal presentation, Summer 2021.

<sup>11</sup> [New Developments in Space Solar Power](#). John C. Mankins, [NSS Space Settlement Journal](#), December 2017.

<sup>12</sup> "IAA Decadal Assessment of Space Solar Power: A Progress Report" John Mankins, 72nd International Astronautical Congress 2021, IAC 2020 / C3.1.1.

<sup>13</sup> [New Developments in Space Solar Power](#). John C. Mankins, [NSS Space Settlement Journal](#), December 2017.

## The real star of Israel's Blue Flag air exercise

The Scorpius electronic warfare system works against manned and unmanned aircraft, missiles, drones and cruise missiles (with Permission)

by Dr. Stephen Bryen, Senior Fellow, Center for Security Policy; Former Deputy Under Secretary of Defense  
2021 November 18 <https://asiatimes.com/2021/11/the-real-star-of-israels-blue-flag-air-exercise/>



*A test of Israel's David Sling's missile defense system, a medium-range interceptor, developed with United States backing. The Scorpius electronic warfare system was the star of the latest air defense exercises in Israel. Photo: AFP / Israel Defense Ministry*

Israel conducted its fifth Blue Flag air exercise at the Uvda Air Base in the southern Negev from October 17th until October 28th. A number of countries participated in flying 4th and 5th generation aircraft.

The primary focus was on cooperative operations that involve the newer aircraft and tactics for dealing with enemy air defenses. But Israel also showed off something entirely new: the training version of its new Scorpius electronic warfare system which may have been the star of the show.

Scorpius is Israel's new electronic warfare system. It provides a unique capability against air threats including manned and unmanned aircraft, missiles (including air defense missiles), drones and cruise missiles.

The system, which comes in land, naval and airborne versions, also includes a training version, Scorpius T, that was part of the Blue Flag exercise.

Scorpius can be thought of as a type of jammer, but it differs significantly from other jammers because it combines both wide-area search and narrow-beam radars, making it possible to scan against threats and select specific targets which can be countered by the narrow beam part of the system.

Called a "soft kill" capability by the Israeli contractor, Israel Aerospace Corporation (IAI), the narrow beam can shut down radars and kill communications. Scorpius can work on multiple radar and communications frequencies and probably includes a built-in threat library to identify enemy targets.

IAI says that Scorpius can detect stealth aircraft and for that reason alone is a game-changer. China has developed and deployed the [J-20 stealth fighter](#), modeled on the US F-22, and will soon deploy a lighter stealth fighter called the [J-31](#).

## The real star of Israel's Blue Flag air exercise



*China's twin-engine, multi-role J-20 fighter can reach speeds of 2,100 kilometers per hour. Photo: AFP / ImageChina / Li Jianshu*

Russia has just announced the Checkmate, its first single-engine jet fighter (which may also include an unmanned version) and is beginning to deploy the Su-57 which has a lower radar signature, though not quite stealth.

Conventional jammers try to jam on all frequencies and thus disable an enemy aircraft or radar. The drawback to such a system is that when it is operating it can also kill friendly aircraft.

Another weakness is that it is operating on multiple frequencies, making the jammer a "hot" radiation target for any weapon that can home in on its radio emissions.

Russia featured its Krakushka (Belladonna) advanced jammer system in the Nagorno-Karabakh war and Krakushka has also been deployed in Syria and near the Ukraine. It is a road-mobile wide-area system that seeks to confuse GPS and other signals. Strategically Krakushka was designed to jam US and NATO AWACS radar early warning aircraft.



*A US Air Force E-3 AWACS, or Airborne Warning and Control System, aircraft, which are not armed. Photo: AFP / Ethan Miller / Getty Images*

## The real star of Israel's Blue Flag air exercise

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Scorpius on the other hand is based on a high-powered AESA radar platform that looks for certain signals such as radars in missiles.

Increasingly Russia, China and others are adopting long-range interceptor missiles for air defenses and for air to air missiles. Examples include the S-500's interceptor missile 77N6, which is hypersonic and has a range of 370 miles; the Vypel R-77 with a range of 120 miles, and China's PL-12 and PL-15 with claimed range of 120 miles.

These missiles all use active radars (sometimes combined with a terminal infrared seeker) which means they can be detected and jammed. Scorpius is able to detect such active radars at great distances and can jam both the aircraft and the missiles. This is especially significant since hypersonic missiles may be difficult or perhaps impossible to kill kinetically but are vulnerable to soft kill measures if available.

One of the main points of the exercise was to simulate air defenses and learn how to fly against them. Italy and Israel supplied F-35 stealth jets permitting the participants to take advantage of the F-35's superb radar set to fix enemy targets and share those targets with 4th-generation aircraft such as the F-16, the Mirage and the Eurofighter.

The F-35 can act as a flying AWACS (airborne early warning and control system) and also provide electronic countermeasures and radar warning capabilities thanks to its sophisticated AESA (airborne electronically scanned array) radar.

Also, it can share data instantly with other aircraft if they have Link 16 or equivalent onboard systems. Link 16 is a military tactical data link network used by NATO and other nations including Japan and India. India flies Russian, French and British fighter aircraft.

Around 80 aircraft from various countries participated in the Israeli air exercise which, as it turns out, was important for improved regional defense and for NATO. Britain participated for the first time along with the US, France, Italy, Germany and Greece from NATO India also sent warplanes and a number of countries came as observers including the chief of the UAE Air Force. Other observers included Japan, Romania, Finland, the Netherlands, Australia, South Korea and Croatia.

The result of the exercise is that the F-35 when combined with the Scorpius system offers the possibility of tactical and strategic dominance in the battle area and reduces the threat of counter-stealth systems and beyond-visual-range (BVR) air to air and air defense missiles.

Even if a country lacks the stealthy F-35, it would seem that the Scorpius system offers a way to identify threats at long range and use Scorpius's soft-kill capability to take them out. As such this can be a game-changer even against hypersonic threats.

When equipped with a Scorpius pod under the airframe or supported by a ground- or sea-based Scorpius platform, an older generation aircraft can aggressively respond to long-range threats that depend on radars and other electronics to go after their targets.

## On Taiwan: Can America Get Its Act Together?

by Dr. Stephen Bryen, Senior Fellow, Center for Security Policy; Former Deputy Under Secretary of Defense  
2021 November 12 (with Permission)

[https://www.theepochtimes.com/on-taiwan-can-america-get-its-act-together\\_4101987.html](https://www.theepochtimes.com/on-taiwan-can-america-get-its-act-together_4101987.html)



A sailor signals an FA-18 hornet fighter jet to take off from U.S. aircraft carrier Theodore Roosevelt in the South China sea on April 10, 2018. (Ted Aljibe/AFP via Getty Images)

### Commentary

I think it is more than fair to say that the United States does not have a [Taiwan](#) policy. Believing in strategic ambiguity, which is what [many in the administration](#) and [lots of so-called smart scholars](#) think is a policy, definitely does not measure up as one.

In fact, if your strategic concept is ambiguous then you have no firm direction and no reason to execute any program, other than sit on a log and scratch your head, or whatever else you scratch.

A policy implies one has a program that can be applied. In regard to Taiwan, there isn't one.

There is, of course, "guidance" in the [Taiwan Relations Act of 1979 \(TRA\)](#). The TRA was a desperation measure by Congress after President Nixon and Secretary of State Henry Kissinger decided to abandon Taiwan and embrace China.

But what does the TRA do? In effect not much except for one key provision that reads as follows: The TRA "Declares that in furtherance of the principle of maintaining peace and stability in the Western Pacific area, the United States shall make available to Taiwan such defense articles and defense services in such quantity as may be necessary to enable Taiwan to maintain a sufficient self-defense capacity as determined by the President and the Congress."

In practice it has meant selling largely second-hand equipment to Taiwan making sure that Taiwan has no offensive firepower. When Taiwan, for example, decided to build its own fighter plane, called the F-CK-1 Ching-kuo, the United States would only authorize small engines for it and limited the plane's fuel capacity so it would be of no use against China.

## On Taiwan: Can America Get Its Act Together?

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But even if the United States actually supplied front-line, first-class equipment to Taiwan, it is simply ludicrous to think that Taiwan, an island of 23.57 million could stand up to China with a population of 1.402 billion, and a strong military to match its population size and wealth.

With this in mind it is very clear that Taiwan needs help to stave off any Chinese invasion. Every serious analyst knows this to be the case. Had the United States not intervened with two aircraft carrier task forces in 1996, Taiwan would have been toast.

China, under the guise of carrying out a missile exercise in the seas around Taiwan, was getting ready to launch an invasion force. But, with President Bill Clinton finally deciding to move two aircraft carrier task forces into the area to intercede between China and Taiwan, China's leaders backed off and there was no invasion.

Since that time, China has been working on finding answers to U.S. military power, focusing heavily on aircraft carriers, China's number one nemesis. Just recently satellite photos revealed a mock up of a U.S. aircraft carrier in a new shooting range in the Taklamakan desert in Xinjiang. The fake carrier includes a rail undercarriage so China can practice shooting at a moving aircraft carrier.

China has a relatively new missile, the [DF-21D](#), which China calls a carrier killer. Allegedly it can travel over 1,000 miles and destroy a carrier. It is likely the DF-21D can be shot out of the skies by U.S. missile boats that always accompany U.S. carriers, but no one knows for sure. Meanwhile China is trying to sharpen its skill at hitting a carrier, suggesting they lack confidence their missiles are all that good.

China has also built a number of sophisticated helicopter assault ships for a future Taiwan invasion, including the Yuchao class Type 071 and the Yushen Type 075 amphibious assault ships. China believes that if it can blast Taiwan's airport runways and shoot down its F-16's, Taiwan will lack the means to stop an amphibious assault on the island.

But China's big fear is U.S. airpower, particularly U.S. stealth fighters. China's Chengdu J-20 (known in China as the Mighty Fighter) is a stealth air superiority fighter that is better than anything Taiwan has, and is modeled on the US F-22 Raptor. But the Raptor is, according to most experts, far better than the J-20 and, more importantly, it is the only fighter aircraft China really fears because it can defeat Chinese aircraft and air defenses.

Yet the United States has no F-22s in the western Pacific, not even on Guam which is far away from Taiwan. It is true that the United States deployed 25 Raptors to Guam and Tinian as part of a big air exercise called Operation Pacific Iron. But afterwards they went back to their bases in Hawaii and Alaska.

Given China's serious preoccupation with the F-22, perhaps fear is a better word, it would make sense to base them near to where the action is, for example in Japan or on Okinawa. Yet the Biden administration has been reluctant to do anything more than air and sea exercises and isn't strengthening the U.S. capability where it is most needed.

## On Taiwan: Can America Get Its Act Together?

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Anyone who reads the constant reports on China's new weapons might feel that America's defeat is inevitable and the best policy is not to try and get in China's way. That approach can be found in the Pentagon, which appears to have convinced itself that it [will lose any fight with China](#) if we tried to come to Taiwan's assistance if China attacked.

To buttress its negativity, the Defense Department, sometimes on its own, sometimes with contractors such as [Rand Corporation](#) and sometimes in collaboration with Think Tanks, has run any number of simulations and war games, all of which tell Pentagon decision-makers that they can't win a fight with the Chinese.

But all these exercises have major flaws. They assume that China's military will perform flawlessly and her military equipment will work perfectly. Such assumptions go way too far, since China's new hardware is not battle proven nor is it clear that Chinese systems work anything like advertised.

Worse still, once the Pentagon convinces itself it is hopelessly outgunned, it does not develop plans to challenge the Chinese. Real deterrence involves convincing a potential adversary that you have the means to fight and win.

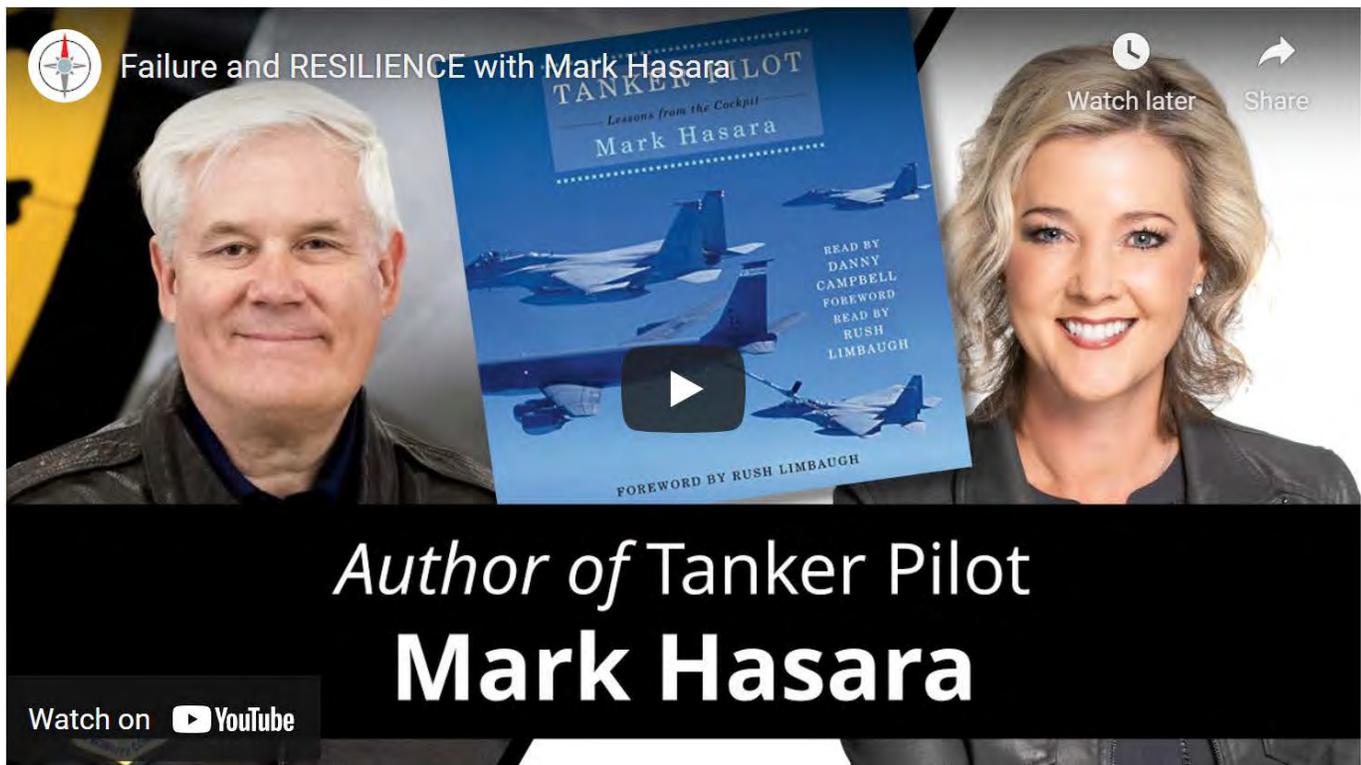
If the United States was practicing deterrence, it would be doing a lot more than carrying out some military exercises against a phantom enemy or threat. For example, the United States would not allow Chinese fighters and bombers to circle around Taiwan violating Taiwan's Air Defense Identification Zone and crossing the dividing line that has kept both sides apart for many years. Just as we shadow Russian planes that fly near our coastline, the US should be shadowing China's aircraft around Taiwan's airspace. More than that, we ought to be coordinating operations with the Taiwan Air Force (officially the Republic of China Air Force) and with our allies, especially Japan.

As things stand now, Washington is talking out of both sides of its mouth when it comes to the threat from China. We are making dubious deals with China even while China is behaving more aggressively. This makes little sense unless the U.S. intention is surrender to the Chinese. For sure, Washington does not have a policy that can prevent war in the region and is behaving in a contradictory and confused manner. Any more of this and the Pentagon's war games will become a self-fulfilling prophecy.

## Failure and Resilience with Mark Hasara

Interview and Transcript, *Deliberate Directions*, (2020 June 22) (with permission)

<https://www.deliberatedirections.com/failure-and-resilience-mark-hasara/>



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

*Retired Lieutenant Colonel Mark Hasara was fired from his dream job and feeling like he hit a career wall. What happened next has changed his life.*

*During the interview we discuss why failure is the best human learning environment and the most important lessons Mark has learned about leadership during his time in the Air Force.*



### About Mark Hasara

Mark flew missions in the US Air Force for over two decades during the Cold War, Afghan War and Iraq War. In his book *Tanker Pilot* he tells stories from his journeys and shares the lessons he took from the battlefield that we can all apply in our lives whether at home or at work.

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## Failure and Resilience with Mark Hasara

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### Who Is Mark Hasara?

**Allison:** Welcome back to the [Deliberate Leaders podcast](#). I am your host, [Allison Dunn](#), Executive Business Coach and owner of [Deliberate Directions](#) where we are dedicated to helping leaders build strong, thriving businesses. Each episode we feature an inspiring interview to help you on on your leadership journey.

Today, I am so excited to introduce [Mark Hasara](#). He's the author of [Tanker Pilot: Lessons from the Cockpit](#) and you have a quote in here - "*Nobody Kicks Ass Without Tanker... Nobody!*" That's so awesome!

**Mark:** That is the motto of the tanker fleet and it has been for a long time.

**Allison:** Oh, it's the motto. Okay. I saw that underline in the book you sent me and that was pretty fun.

I want to do a formal introduction. Mark is a retired Lieutenant Colonel who flew missions in the US Air Force for over two decades, during the Cold War, Afghanistan War, and the Iraq war. And, gosh, thank you so much for your service. That's incredible.

And you are the author of the book *Tanker Pilot*. And this is where you tell stories from your journeys. You share the lessons that you took from the battlefield that we can all apply in our lives, whether we're at work or at home.

Mark, welcome to the podcast. It's so awesome to have you here today.

**Mark:** It's a pleasure to be here with you, Allison, I'm so glad you reached out to me and I've been waiting for this for a couple days. I've been really excited to talk with you.

### What a Tanker Pilot Does

**Allison:** I just want you to be able to provide a quick orientation for listeners. I know what you do because my husband's also an Army to Air Force guy, but [what is a Tanker Pilot](#) for anyone who might not know

**Mark:** I'm gonna tell you what I tell all my wife's friends... I passed gas for a living!

## Failure and Resilience with Mark Hasara

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But it's incredible amounts of jet fuel. For twenty-four and a half years I was a [KC 135](#) pilot flying one of the oldest airplanes in the Air Force inventory. Many of them are older than I am, and I just turned 63. So that tells you how long they've been around. But the KC 135 has been the world's air refueling workhorse since the 1950s.

I'll give you some really interesting statistics. I take off in my airplane on one mission with 180,000 pounds of jet fuel. That's more gas than you will use in your family vehicle in 27 years. That's how much I'm using on one mission during the 26 days of the Iraqi invasion.

The team I lead of 30 people, planned and executed the missions. We transferred over 417 million pounds of jet fuel in 26 days. That will allow a Ford F 150 truck to make 2,685 round trips to the moon or seven round trips to the sun!

And that's why the tankers are there. It's an airborne gas station where airplanes will come up underneath us. We have a flyable boom in the back that has an extended pipe. We stick it in their airplane, and toggles lock us together.

We pump gas just like when you go to Costco. We pump a little bit more than you would normally get at Costco, about 6,000 pounds a minute.

The biggest offload I've done is into a B-52. It was 103,500 pounds of gas on one mission! So when we're talking air campaigns, and humanitarian operations, the KC 135 and the KC 10 touch everything the US does.

Literally, tankers are all over the world. And on any given day, there's about 150 tanker missions a day.

They hook up and there are 100's of missions, at least 160 to 200 missions a day offloading around 8 million to 9 million pounds of gas a day, particularly over in the Middle East. And we connect with a receiver every four minutes.

So that's what tankers do. It's a fun mission. It was really a fun mission. And I really am flying an airplane I wanted to fly ever since I was a kid.

**Allison:** So being in the air, being in the right place at the right time so that you're receiving aircraft that needs the gas.

**Mark:** Yeah.

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## Failure and Resilience with Mark Hasara

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**Allison:** Is that like a line at the gas station just waiting to get more fuel?

**Mark:** Great question.

Sometimes it's a single receiver like [B-52 bomber](#). Sometimes, like during the Desert Storm war, we had to go into Iraqi airspace and pick up 32 [F-16s](#) that didn't get gas going to the target, they were critically low on gas. The F-16 that came to my airplane first only had 800 pounds of gas in it. Six minutes! That's how long he had before he ran out of gas when we hooked up to it.

So sometimes we have eight, sometimes we have one. Sometimes we're in formation where there's four tankers and eight receivers on each one of us. Sometimes it's a long line at the gas station. Sometimes it's a short line at the gas station.

Typically in the Middle East right now, we'll have four to six receivers on us at any given time. And we will give them anywhere between 10 to 15,000 pounds of gas each airplane.

**Allison:** So this is an aerodynamic exercise that happens.

**Mark:** Yes.

## Close Calls on Missions

**Allison:** Did you ever have any close calls? Or you know, just like complete concern, like now you're attached?

**Mark:** Yes!

My very first Combat Support Mission in 1990, the very first one we connected with a Royal Saudi Air Force F-15 fighter jet. He saw us all up in the plane taking pictures in the window. So he's waving at us and talking to us and everything like that... he wasn't watching what he was doing and ran underneath us so we couldn't pull the pipe out.

He broke the nozzle off of the end of our boom. Gas was just flying out of the back because the pumps were still on. He got out of the way and you could see our big nozzle... and it's a big piece of metal... still in his airplane. Of course, it belonged to me.

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## Failure and Resilience with Mark Hasara

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One of the funniest lines I've ever heard during air refueling, he comes up to us and says, "I need more gas!"

I said you just took the way only way we can give you gas. He looked over like this, looks up at us. He goes, "We make air mess. No!?!?"

Yes... yes, that's exactly what we did!

He goes, "Okay, I go home now." And he just left. Three days later that big piece of metal showed up on a table in our maintenance office. They'd sent it back to us but most of the time, refueling goes without any problems. We have an interphone system so that when the two airplanes are hooked up... we can talk back and forth through the boom and we'll discuss everything from football games to what kind of Chick-fil-A sauce you have in your room.

**Allison:** That's great.

**Mark:** There's a really good video of guys talking back and forth and they're talking about how Chick-fil-A really takes care of the troops. They had sent packages of their Polynesian sauce over to the Gulf region. In a box I think there was like 3,000 packages they were all divvying up. They were talking about that while they are air refueling.

## The Roles Mark Worked in the Air Force

**Allison:** That's funny. Like I'm super curious. Over the years what have been some of the roles that you've played in the Air Force in your career?

**Mark:** I've been an instructor pilot and I'd also been an instructor at two schools. One of them I created, I helped create. The Air Force has its version of Top Gun. It's called the Air Force Weapons School. They just had their graduation this weekend.

I was the deputy commander of the Initial Cadre of about 16 officers and non-commissioned officers that created the KC 135 Weapons School. Our syllabus had 482 academic hours, 18 five-hour flights, a three-hour simulator ride, and a graduate-level paper all accomplished in 19 weeks. Yeah, so it was the graduate level, Ph.D. level school for tankers, and we started that in 1999. This class, we have now over 200 graduates and it's been going for 20 years. So it's going very well.

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## Failure and Resilience with Mark Hasara

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I tell everybody, that's the worst assignment of my career because nobody thought there should be a tanker school like this. But we kept going and kept doing it. And our third class was going through on 9/11.

The next day, several of our graduates got sent all over the world to create air refueling plans to defend the United States to prepare for operations in Afghanistan. So it's one of the most rewarding experiences I've had, too.

I've taught at National Defense University, international students, which was a lot of fun meeting all the different international students... German, Italian, we had a Chilean ship captain, so forth, but mostly it's going around the world passing gas into receivers and international partners.

That was also another really fun aspect of working with US allies and learning their culture. People ask me, "Well, what was your favorite place?" And I say, "the one where I enjoyed flying the most, or the one where I enjoyed the food the most!"

**Allison:** Which one did you enjoy flying the most?

**Mark:** My flying assignment in Okinawa, Japan was by far the best assignment I had. It was the most educational assignment I had too... a great learning experience. We had a terrific Wing Commander who told all of us, "I want you flying in everybody else's airplanes. If you're a tanker pilot, I want you flying in the F 15. You helicopter pilots, I want you flying in the Airborne Warning and Control Systems airplane."

We could all fly amongst the different airplanes. We got to know each other well, to the point I could hear a person's voice in my headset, Allison, and I knew exactly who was sitting in the cockpit.

***When your team gets to that point, where you can recognize voices, you know you're on the same sheet of music.***

It was a wonderful assignment to be there under that kind of leadership, working with those kinds of people, making a real difference in the world, flying training missions and humanitarian missions throughout the Pacific. It was just a lot of fun.

## Taking Mark's Wife to Europe

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## Failure and Resilience with Mark Hasara

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**Allison:** Going back to your other question. Where did you enjoy the best food?

**Mark:** Oh, man, that's a tough one. Okay. I spent five months in Italy during the Kosovo campaign, and nothing beats an oven, fire in it, and Quattro Formaggi pizza... four cheese pizza.

But we had a wonderful sit-down, kneel down, place in Okinawa, where we got the really good Japanese noodles. This Japanese noodle house, which was fantastic, all of my kids loved it. I've had some really great things to eat.

I'm not a fish eater. I don't do seafood. My wife does that kind of stuff. But again, there were just great places to eat.

I recently took my wife over to Europe and took her to some of the places I had been. Got to try some of the food and so forth. Places we'd go I told her, "Yeah, I took off from that runway, and that runway, and that runway!"

## Nicknames, Code Names, and Callsigns

**Allison:** That's awesome. Curious, so you brought up [Top Gun](#), which was a pivotal movie in my teenage years. And it's [coming back out](#) I think, later this week, right?

**Mark:** I think they put it off until the fall. Which was really disappointing. I was so disappointed when I heard that you know, I'd really love to see that movie. But I think they put it off until around Thanksgiving or something.

**Allison:** I can't wait to get it because they want to relive when people can actually go to the movies. Yeah, so that made me think you know, how they like they had names for each other. So you know, there was Goose... do you have a nickname or code name?

**Mark:** I do have a nickname, a tactical callsign. My callsign is Sluggo, S - L - U - G - G - O. See how I put that in the book at the bottom?

**Allison:** Yes, I did, but I didn't understand it.

**Mark:** So I weighed 11 pounds and was 23 and a half inches tall when I was born. I was a big Sluggo. I got it in pilot training. And that's where it comes from.

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## Failure and Resilience with Mark Hasara

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**Allison:** Oh, that's great. All right. Now I can see that kind of finishes the circle for you.

**Mark:** Everybody's got one you know, and we actually have a call sign night where we will assign call signs to people. It's really kind of fun because it's either something about your character or something really dumb you did... something like that, you know, and when we have those nights where you're given your callsign is really a lot of fun.

## Fired From a Dream Job

**Allison:** In your book, you mentioned that at one point you were fired from your dream job. Yes? And feeling like you'd hit a wall in your career. I know that people will relate to that either they've been there or they're feeling like they're there right now. So, share with us what happened next.

**Mark:** That job I told you about which was the worst four years of my career... it was actually my dream job.

About four years into it, a Colonel that was our commander, fired me, in April of 2001. Previous to that time, my throttles were up! I was enjoying teaching, even though we were getting so much flak on trying to create this school. We knew it was going to make a difference in our community. It really has.

But I got fired. He called me in one day and he says, "You're gonna have to find another job. You're not working here anymore."

So I went to a Wing job at Fairchild in Spokane. They were going to put me in a position I didn't want. It was kind of like being the Maytag repairman for the base. I thought, why would you put a guy with all of this education and training in such a position?

I said, "Look, just let me go down to a squadron, let me teach young kids how to fly, how to do all of this stuff."

Wing leadership said, "Yeah, okay, we'll do that."

As I said, that was April of 2001.

## Deploying After 9/11

## Failure and Resilience with Mark Hasara

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Tuesday morning, 9/11 changed everything.

For a long time, I didn't know what I was going to do, where I was going to go. I was a Lieutenant Colonel, I wasn't going to get promoted because I hadn't been a Squadron Commander.

***So you're kind of at that wall, Allison, where you're like, "Where do I go from here? What do I do now?" It was depressing. I get up and go to work, and I still really enjoyed teaching the concepts of how to do air refueling, and how to fly the airplane. But I knew that my career was over. I thought, "Well, do I get out of the Air Force now and what do I do?"***

Then like I said, 9/11 happened. I got a call at 5:50 in the morning from one of my wife's closest friends who was living in Boise at the time, at 5:50, and she's going "Where's Mark!?! Where's Mark!?! Where's Mark!?! My wife said "He's asleep right here next to me. Stacy. It's 5:50 in the morning, what's up?"

She says, "An airplane has hit a building in New York. Turn on the TV." I'm kind of a news junkie anyway. So I turned it on the TV, I see the building burning. I'm thinking to myself, how could a pilot with thousands of hours run into a building on a clear and visibility unlimited day, but my subconscious was going, "We're under attack!"

I saw the second airplane hit and ran to the shower. While I was in the shower, my Wing Commander called "Mark has to come in right now!"

Eight days after 9/11, I deployed to the Middle East to run air refueling operations across the entire Middle East, which became my real dream job under some really bad circumstances, because we were dealing with so many problems of fuel and airplanes and getting people over there and so forth.

But when you have all of those kinds of challenges, when you've gotten fired, you have real confidence issues and so forth. But I didn't realize God has a plan for you. You may not know what that plan is at the very moment. You're kind of three days from nowhere.

Then all of a sudden, I was doing everything I had been training people to do. I was the Chief of the Air Refueling Control Team, in charge of all air refueling through the Middle East, for about a year and a half for all five nations; the Dutch, the French, the English, the Australians, and the US.

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## Failure and Resilience with Mark Hasara

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I was running air refueling for everyone... We're averaging 265 sorties a day and about 11 million pounds offload a day.

### God's Vector Check

I want your listeners to understand...

***When you get to that wall, just remember there are things on the other side. There are things on the other side of being fired that may be much, much better for you. I call it God's Vector Check.***

**Allison:** Vector Check. Yeah, well said.

**Mark:** Yeah, that's a vector check, because I was really wondering what am I going to do, and then everything changed. Like I said, on that one particular day, and...

***I know a lot of people right now are maybe out of a job or waiting to get a job, or to go back to work, and so forth. Take this time to improve your skills and improve your life. Because when God's Vector Check comes, be ready for it. Be ready for it.***

**Allison:** I love the fact that you call it a vector check, is it just a term that you just made up or is it from somewhere else?

**Mark:** It's something that we use in the military, okay, a vector.

I'm on this heading, and now they want me to go on this heading. Okay? It might be a one-degree adjustment. It might be a five-degree adjustment.

But that Vector Check is an understanding of how Heavenly Father wants you in a position where he can use you.

I was trained and educated to be put in that position. Even though I didn't know it, I had confidence issues from being fired. And here I was now running air refueling across the entire Middle East.

## “Failure Is the Best Human Learning Environment”

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## Failure and Resilience with Mark Hasara

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**Allison:** I think this is a quote from you, you say “failure is the best human learning environment.” This ties into your vector check, you know, feeling like you’re not sure where you’re intended to be.

So I’m using failure as a term that kind of almost the bottom of the vector check. But before you head back up, yes. And what failure did you learn the most from that one? Being fired from that job.

**Mark:** Because you look back and you think to yourself... you do kind of a self-analysis and your mind is sometimes your worst enemy.

You think to yourself, I’m not good enough, I wasn’t smart enough... I didn’t do this, I didn’t do that... I should have been more engaged here and so forth. You kind of talk yourself out of your confidence.

And so, that particular failure I think was one of my greatest learning tools because again, it made me go back and think, you know, I’m so depressed I didn’t do this right. I got fired and I’m now at the end of my rope, what am I going to do?

But yet, situations change... COVID-19 has changed all of our lives. Look for the opportunities, post COVID-19, when things start opening back up, when governors start opening back up, mayors start opening things back up...

I think all of your audience is going to realize, “Wait a minute, here’s a great opportunity that I didn’t think was coming.”

You mentioned before we started here when you were talking that you’ve had some great people on over the last couple of months. Because we’re locked in our houses, we’re looking for things to do. We’re looking for those opportunities.

This is one thing I would tell all your audience:

***Yes, failure hurts, okay? Failure sucks. Embrace the suck! Keep moving forward, keep going forward. Because you never know what opportunity is going to come at the end of that.***

There’s a great quote by, of all people, [Will Smith](#), in a video I watched where he says, “Your greatest joy, your greatest happiness is just beyond your greatest fears.”

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## Failure and Resilience with Mark Hasara

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And that's one of the things I teach about when I get up on stage. Yes, it hurts right now. People are out of work, how am I going to pay my bills? and so forth. But the time is coming, if you are prepared, where your greatest fears will turn into your greatest joy and happiness.

## Trust Lets Your Team Take on More Risk

**Allison:** I completely agree with Mark! One of the things that I always like to ask guests having an interview is what is your number one leadership tip you would share with our audience.

**Mark:** I've had a couple of weeks to think about this since I've been listening to your podcast, so I'm ready for it. All right.

**Allison:** So what's your what's your tip?

**Mark:** Trust, trust, trust. May I give you two stories?

**Allison:** Yes, please.

**Mark:** We were running intense tanker operations, and we didn't have a way to kind of analyze what we were doing. Were we needed measures of performance and measures of effectiveness... are we doing the right things and are those right things moving us in the right direction?

One of the guys working for me came up to me, and he has mad skills with Excel. I do not have mad skills with Excel. Wybo, that was his callsign, does. And he came up to me and he says, "Hey, I've been working on something. Let me show it to you real quick."

He goes through what it was, it was an analysis of all of our operations based on an Excel spreadsheet, that would show us all of the trends, negative or positive, how the airplanes were being maintained, how much gas we're offloading, the number of sorties, airplane missions were flying and so forth.

But particularly, how hard we were flying the pilots and the aircrews. I do not understand Excel, but knowing that he did, I trusted him and I told him, "I want you to run with this, I don't understand it because I don't understand putting formulas in the little boxes, but you do."

## Failure and Resilience with Mark Hasara

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Two days later, he came up to me and showed it to me. I said, “start doing that now.” I told everyone on my team, “This is what we’re going to send out to all 15 bases.”

***The information we were getting back from that spreadsheet was fabulous because it allowed us to be more effective, more efficient. That was because I empowered Wybo to move forward. I trusted him, not knowing how to use Excel, but knowing he did, empowering him to be able to make that sheet.***

We actually went back and used it to defend decisions we were making, to generals and international officers, and so forth. Trust is a great powerful tool in a company.

Your customers must trust you. One of the things we have in the air refueling community, particularly the Air Force KC-135 and KC-10 community, is our customers trust us implicitly. Here’s the story for that.

On the opening night of the Afghanistan air campaign in October of 2001. Mongo was his callsign, had the newest Lieutenant in the Carrier Airwing on his wing. They were flying at night and got to their tanker. There were six airplanes already lined up on their tanker, they would be number seven and eight. Mongo wouldn’t get enough gas and it would make them late for their target. The tanker pilot told him there’s another airplane 370 miles to the north, orbiting over the town of Herat. “Go there and get gas.”

Now, he’s low on gas. He’s got a brand new Lieutenant on his wing and he’s flying on night vision goggles. He has to go 370 miles across the Registan and Dasht-e-Margo deserts. Dasht-e-Margo in Dari means “Desert of Death.”

***He’s flying across low on fuel. But he had such trust in our community that he was able to take a greater amount of risk and assume a greater amount of risk.***

He got a radar lock-on on the airplane at 80 miles. At about 20 miles he sees it visually on his night-vision goggles. But we have to refuel the Navy with a basket that’s on our boom in the back... it’s kind of like a hummingbird shuttlecock... they come up and they plug a probe into it.

It wasn’t until he got about three miles away he saw the basket on the boom. He had to come up... he and his wingman only had about I think he said 2000 pounds in his tanks which meant if the tanker wasn’t there, he was going to

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## Failure and Resilience with Mark Hasara

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have to eject out of the airplane and become a survivor on the ground on the opening night of an air campaign!

But Mongo was able to plug the lieutenant in, then plug himself in and get the gas he needed. He got to his target, did the mission he was supposed to, and then returned.

That's trust! That's trust!

As leaders in our companies and leaders of our teams and our communities...

***That's the kind of trust you want to build with your customers and the people around you so that with your word, they will assume a greater amount of risk because they trust what you say.***

They trust what you do. They know that you will be in the right place, at the right altitude, at the right speed, configured the way you're supposed to be, ready to pass gas, based on your word. TRUST.

**Allison:** I think that that's one of the first words that I use when someone says why... why does someone even hire a coach? And why do they choose you?

My first thing is, I gained their trust. Yes. So that's a big one. I don't know if it's the same answer, but I'm going to ask the question in a slightly different way.

**Mark:** Sure.

## Building Cross-Cultural Relationships

**Allison:** What's the most important lesson about leadership that you've learned during your career?

**Mark:** Relationships... creating relationships.

**Allison:** Can you give me an example?

**Mark:** Okay. I was working in the command center, where the air campaign was being run from for the invasion of Iraq. We had about 1,000 people in there, and I worked in what was called the Master Air Attack Plan Cell.

## Failure and Resilience with Mark Hasara

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One night as I looked around, and we're were working on a really, really tough problem supporting the troops that were on the ground, having the right fighters and the bombers... giving them enough gas and so forth.

I looked around the room. There were about 15 to 20 people I had known throughout my career that were now in that group of people. We had established relationships early. One of the Navy planners had been my next-door neighbor in the 1990s.

Trigger was his callsign. He was one of the planners for the Navy. The Chief of the Navy Planning Cell happened to be a Captain on a ship I had been on for a week. He had allowed me to go up in a Navy airplane. Got a cat shot takeoff and an arrested landing. He was working about 30 feet away from me. As I looked around the room, I realized all of us knew each other. All of us knew each other's strengths and weaknesses. We'd work together before in some really tough situations.

Now all of us are working together to perform the different missions and tasks, planning, executing them, and so forth. It wasn't until much later where one of the Navy captains who was on one of the carriers we were supporting, his call sign is Moose, says, "Do you realize how we all knew each other? I thought about that one night when we're working on this problem.

***Relationships are a big deal. Develop those relationships with the people around you. You never know if someone passing 10 feet away from you is the person that will make you successful. There are so many stories about people meeting somebody on the street saying I am this person and I do this. Are people going out and meeting those people that can help make them successful? Those relationships sometimes take a long time to build.***

But I'll tell your listeners one thing that I do whenever I'm going to a foreign country, and I know I'm going to be working with a team, for instance, this Jordanian team we're working with. I learned a few Arabic sayings like "hello", "how are you?", "thank you", "goodbye", those kinds of things.

I remember being in this meeting, and of course, we're going around the room introducing each other and there's about 20 of us in the room. I looked at this Jordanian CEO, and said "Salaam Alaykum, Sadiq! Kaif Halak?"

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## Failure and Resilience with Mark Hasara

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He just beamed because I was saying “hello, my friend. How are you?” That really did a lot to create a great relationship between his team and mine. Because he knew I’d been there, sampled the food as always.

But I understood their culture. And I was willing to take some time to learn about his culture, about his language. It really helped break down some of the barriers that we had later on where we had to work out some problems. But again, because...

*We had strengthened that relationship through just learning a few things about their culture, and being able to say “hello”, “how are you?”, “thank you”, “goodbye”. That went a long way to help create that intimate relationship.*

## Compassion: Reaching Out to Someone Who Says They’re Fine

**Allison:** Such gold advice! Thank you. Your book is about failure and resistance and compassion and opportunity and vision and initiative and discipline and the essence of the book of virtues that I think certainly our nation needs to be relying on as we struggled through the variety of things that we have going on right now. Because we’re finding our way forward. Is there any final advice that you would suggest to those who recognize that we need to adjust and overcome?

**Mark:** There’s a chapter in the book where I talk about compassion. It’s something that you’re not seeing a lot in the news right now... reaching out to help somebody that is having a hard time.

There’s a story in the book which talks about, I was watching CNN one night at work, you cannot believe the number of times the American military has spun up based on a CNN news report! I could go on about that.

**Allison:** I can imagine.

**Mark:** Yeah, this particular night, actually, it was in the morning. We were watching the TV screen. And Korean Airlines Flight 801 crashed in the mountains, the hills short of the runway at Agana, Guam. I reached over and I grabbed my boss and said, “We’re gonna... we’re gonna get tasked here soon.”

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## Failure and Resilience with Mark Hasara

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Sure enough, about 30 minutes later, Vice President Al Gore's office called, asking what can you guys do? And we were already working on a plan. One of the survivors, the only US survivor, if I remember right, was a little nine-year-old girl by the name of Gracie Chung. She was badly burned because she would not leave her mother. Many of the Koreans that were on the airplane were also badly burned.

But because the United States is such a compassionate nation... and I hope your audience understands that, in spite of all that you're seeing on the news and all these terrible stories you're hearing, we are a compassionate nation and whenever somebody needs help, who do they call? They always call the United States.

We had to develop a mission to take the National Transportation Safety Board Go-Team, about 17 people, from Washington DC to Guam, to investigate the crash. And while they were there, we had to bring some of these burn victims back home to the Army and military facility that specialized in burn victims.

I think when we become successful and we have the ability to help people in need, whether it be monetarily, emotionally, spiritually, physically, whatever happens, whatever it might be, take those opportunities to show compassion. Even walking down the street. We have a great bike path behind us and I walk on it every day.

***I always take the time to say hello to everybody I talked to... "How are you?" "How are you doing today?" I think this world would be so much better if we just took the time to show a little bit more compassion to those around us, compassion to those that need help, compassion to people when they say, "Oh, I'm fine."***

You know, we all know what fine really means.

***Lift them up and take every opportunity you can, particularly when you become successful. It gives you a greater ability to show compassion.***

That's one of the great things that I've learned through not only my personal life, but my military career. That was probably one of the most rewarding missions I helped plan and execute. That's one that has always stuck in my mind.

## Failure and Resilience with Mark Hasara

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Knowing that little Gracie Chung and five other of these Koreans were able to come here to the states, get treated, and having a hand and being able to bring them back.

Unfortunately, Gracie died during her third surgery, but four Korean nationals had a great story to tell when they got home. And there's a monument on the [Nimitz Hill](#) now.

And every year, they have a lot of the passengers come back. And you know, they say cantations and they hug each other and they're constantly telling the Americans, "We are so happy you guys got involved in this. Great amount of compassion you showed us by helping us."

## "Embrace Failure as an Opportunity to Learn"

**Allison:** I can't thank you enough for your service, first and foremost.

Secondly, for sharing such sage advice... so building trust and creating strong relationships, you showing compassion to those people you come across.

And then my two favorites, which are the Vector Check idea. Like, I think I may actually give you 100% credit for it, but I feel like it has to be part of my compass, my Deliberate Directions concepts. So going on out into world embrace the suck, right?

**Mark:** Yeah. Yeah...

***Embrace failure as an opportunity to learn. And a lot of times we think, "Oh my gosh, you know this really sucks!" Everything like that, you need to turn the mindset around. What am I to learn from this? Is there a skill set I need? Is there a mindset that I need to change?***

Failure and what it does to us is something *positive*. And that's one of the things that I speak about in a keynote speech. I give a keynote called "[Aviate, Navigate and Communicate](#)," and I use God's Vector Check during that speech to talk about it.

**Allison:** Maybe I'll go and search that one afterward, listen to it so that I can do it justice.

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## Failure and Resilience with Mark Hasara

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[\*Tanker Pilot\*](#) is available on Amazon. Thank you so much. It has been such a pleasure, spending time with you here today.

**Mark:** Thank you very much for having me on. I really enjoyed this. And remember, audience...

*Good days are coming. The great days are just around the corner. You'll be good.*

**Allison:** Excellent advice. Thank you.

**Mark:** You're welcome.

## A Bonestell Thanksgiving

by Ron Miller (Chesley Bonestell is a well-known / legendary aerospace artist)

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Credit: Wikipedia

### The Landing of the Pilgrims by Henry A. Bacon (1877)

Tradition tells us that in December 1620, a collection of pilgrims fleeing religious persecution in England disembarked from their ship, the “Mayflower,” by stepping onto an enormous stone jutting from the Massachusetts seashore. I say “tradition” since there is no mention of a rock being the Pilgrims' landing place until 121 years later.

## A Bonestell Thanksgiving

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*Credit: Wikipedia*

### **Plymouth Rock**

Whether or not this was the first landfall of the Pilgrims, the rock has become a fixed image in American history and folklore. In 1867, an ornate granite canopy was erected over the stone, which had until that time had been badly damaged during different attempts to move it (to say nothing of bits and pieces being chipped off by souvenir hunters and museums).

## A Bonestell Thanksgiving

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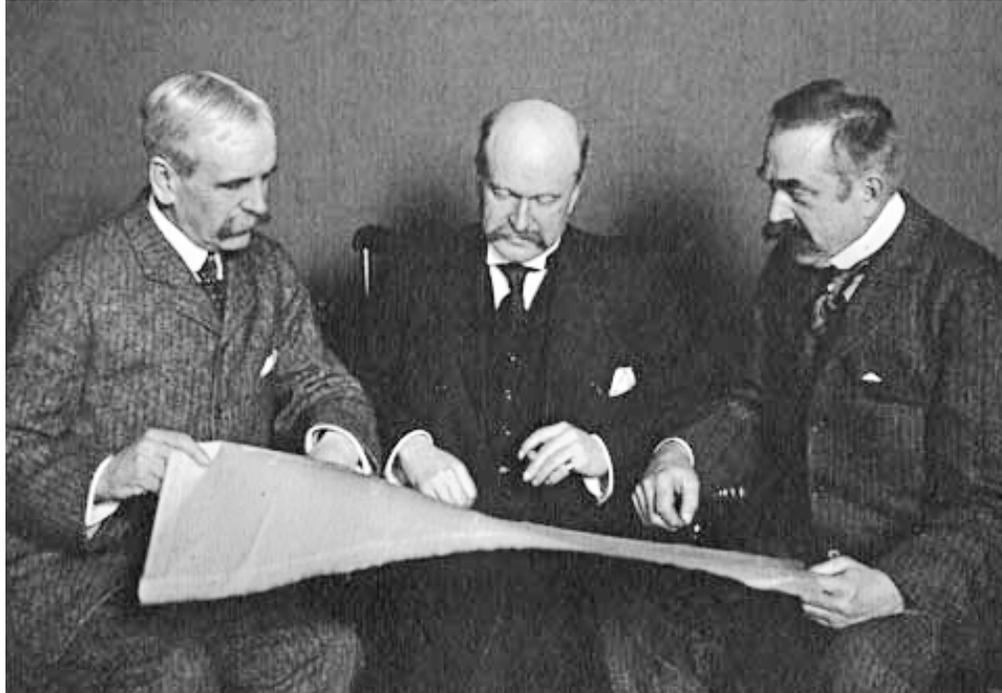
*Credit: Wikipedia*

### **The first Plymouth Rock Canopy, built in 1867**

This monument stood until 1920, when on the 300th anniversary of the Pilgrims' landing, the National Society of the Colonial Dames of America made a gift of a new canopy or peristyle. The rock was relocated to a new park on the Plymouth waterfront, designed by landscape architect, Arthur Shurcliff.

## A Bonestell Thanksgiving

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*Credit: Wikipedia*

### Architects William Mead, Charles McKim and Stanford White

The commission for the design of the canopy was given to then-renowned architectural firm of McKim, Mead & White, already famed for their designs for Pennsylvania Station, Madison Square Garden, the Morgan Library and the iconic arch in Washington Square. In turn, McKim, Mead & White turned the project over to a 32-year-old designer named **Chesley Bonestell (1888-1986)**.



**Chesley Bonestell circa 1915**

*Credit: UC Berkeley Library*

Bonestell replaced the old, ornate, Victorian monument with a dignified portico in the classic Roman Doric style.

## A Bonestell Thanksgiving



Credit: National Archives

### Chesley Bonestell's 1920 redesign of the Plymouth Rock peristyle

The new canopy—which stands to this day—is located on Harbor View Drive in Plymouth. The rock itself sits below the level of the spectator and is protected by iron gratings. The monument encloses the rock on three sides and since the rock was now at water level, the fourth wall is open to the sea, allowing the rock to be flooded during high tide.



Credit: Upstateherd/Wikimedia Commons

**Plymouth Rock was added to the National Register of Historic Places in 1970 and is visited most years by over one million people.**

This was a busy time for Chesley, as demonstrated in the award-winning documentary, [Chesley Bonestell: A Brush With The Future](#). When he was assigned the job of designing the Plymouth Rock peristyle, he had only just recently completed work with architect Willis Polk in the rebuilding of San Francisco following the devastating earthquake of 1906. Between 1920 and 1921 he worked for a number of architectural firms in New York. Shortly after his aforementioned work for McKim, Mead & White, he moved to England where he spent several years contributing architectural illustrations to the prestigious *Illustrated London News*.

## A Bonestell Thanksgiving

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*The Illustrated London News*

**Chesley Bonestell's rendering of "The World's Tallest Building" to be built in Rome, next to the Vatican. From the January 23, 1925 issue of The Illustrated London News.**

## A Bonestell Thanksgiving

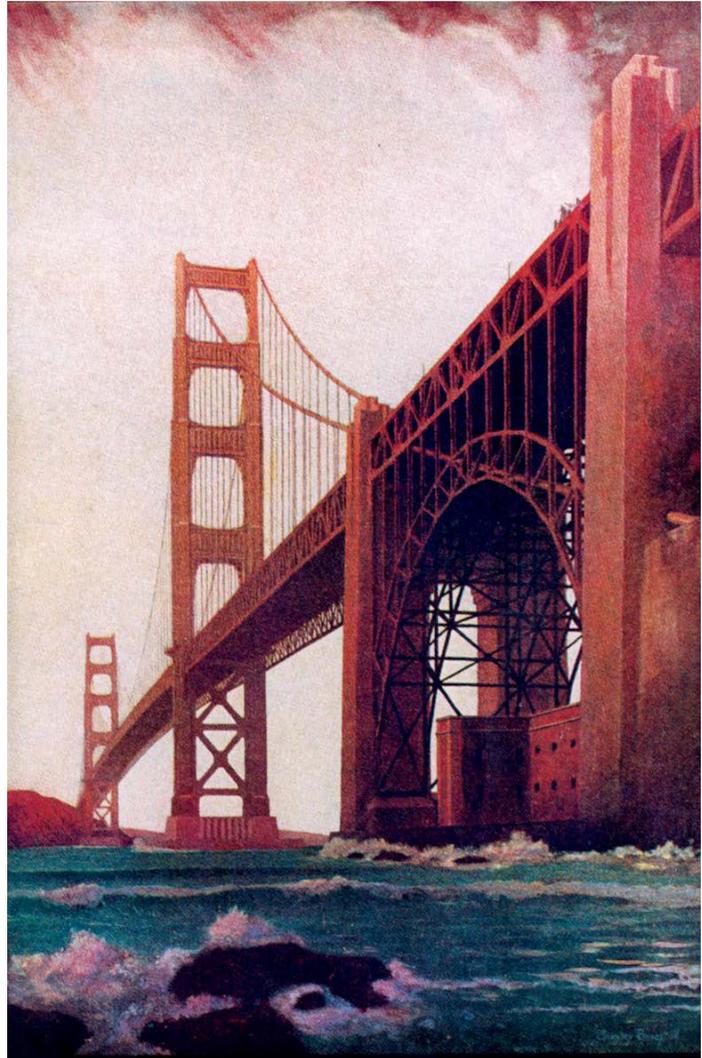
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Over the next decade, Bonestell worked on some of the most iconic structures in the United States. These include:



*Architectural Forum*

**The Chrysler Building by Chesley Bonestell,  
from Architectural Forum magazine,  
October 1930**



*Golden Gate Bridge Highway and Transportation District*

**The Golden Gate Bridge by Chesley Bonestell  
(c.1933)**

## A Bonestell Thanksgiving



*Credit: Wikipedia*

### **The Supreme Court Building in Washington, D.C., completed in 1935**

Bonestell's background as an architect and, especially, as an architectural renderer (an artist who creates a drawing or painting of what a finished building will look like) was one of the most important foundations for his later career as a space artist in that it gave him a commanding mastery of perspective, light and shadow that you can easily see not only in his spacescapes but especially in his depiction of spacecraft.

Perhaps this Thanksgiving, when we think about such cultural milestones of the twentieth century as the Golden Gate Bridge, "Citizen Kane" or the American space program, we might send a silent "thank you" Chesley Bonestell's way.

## A Bonestell Thanksgiving



Credit: Wikipedia

### Pilgrim Memorial State Park in Plymouth, MA

You can enjoy a brief excerpt from *Chesley Bonestell: A Brush With The Future* that highlights some of Chesley's architectural contributions to the skyline of New York by clicking [here](#).



<https://vimeo.com/647956486>

You can enjoy a brief excerpt from *Chesley Bonestell: A Brush With The Future* that highlights some of Chesley's architectural contributions to the skyline of New York by clicking [here](#).



Gobble-gobble!

The Chesley Bonestell Film Team wishes you and your loved ones a very Happy Thanksgiving!

-Doug Stewart, Ron Miller, Melvin Schuetz, Christopher Darryn, Kristina Hays and Jim Castle

Please visit our website at [www.chesleybonestell.com](http://www.chesleybonestell.com)

## A WINDOW SEAT ON THE FUTURE

By Douglass M. Stewart, Jr.



Photo by Linzee Alcaide

*This image of the SPACE X Dart was captured by passenger Linzee Alcaide on her flight from San Diego to San Francisco Tuesday night. An unlucky 5-hour flight delay turned into a once in a lifetime experience to see the launch.*

## A WINDOW SEAT ON THE FUTURE

Who would think that a lengthy flight delay would result in a once-in-a-lifetime experience? That's what happened to **Linzee Alcaide** when she boarded United Airlines flight UA651 in San Diego on Tuesday, November 23. Linzee, a senior at San Diego State University and a major in psychology, was headed to San Francisco to spend the Thanksgiving holidays with her family. Before it was changed, San Diego International Airport used to be called "Lindbergh Field," named in honor of **Charles "Lucky Lindy" Lindbergh**, the first pilot to fly solo from New York to Paris non-stop. He did it in 1927 in a single-engine plane named "The Spirit of St. Louis" and the trip took 33 ½ hours. At that time, air travel for the public was not available but since then, things have certainly changed.

Delays at the airports during holiday travel times are almost par for the course. Linzee's flight was no exception. Due to mechanical problems and a required crew change, her plane wasn't ready to board until five hours after its originally scheduled departure time of 4pm. "The flight was full and by the time we left San Diego, everyone was pretty stressed out, as you can imagine," said Linzee.

From her window seat, she noticed that everyone had lowered their window shades. Linzee was the only one who didn't. "Not long after we passed by Los Angeles and headed up the coast, the clouds below started to illuminate. They looked really beautiful and I took out my iPhone. I saw this shiny thing coming up through the clouds and took a picture of it. I didn't know what it was until I landed in San Francisco and showed the picture to my dad, a software engineer. He told me that I had photographed the SpaceX Falcon 9 DART launch that had just taken place at Vandenberg Space Force Base. We both were amazed at how fortunate I had been." When asked about how she felt about this stroke of good luck, Linzee replied, "I felt really special. I was actually grateful for the flight delay. It allowed me to capture something really beautiful." Would this experience make her consider a career in aerospace? "Not really," she said. "But this whole thing was really cool!" A moral to this story: Don't grumble next time your flight is delayed. Something magical might happen because of it!

Just ask Ms. Alcaide, whom we shall dub "Lucky Linzee."

### About the Author:

Douglass M. Stewart, Jr. is the Producer/Writer/Director of the award-winning documentary, *Chesley Bonestell: A Brush With The Future*. [www.chesleybonestell.com](http://www.chesleybonestell.com)

## Aircrafts Cockpit Touch Screen using Control Display Concept

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### Abstract

One of the main disadvantages of CDUs is that it is difficult to see the input data while looking at the outside world. The Touch Screen Unit (TSCU) is a new technology making its debut under the Control Display Concept. This unit is designed to fit in the standard size of a conventional Cockpit Display Unit and be used for both retrofit and new installations. The TSCU offers two major advantages. First, the interface can be reconfigured to enable consecutive execution of several tasks on the same display area, allowing for a more efficient use of screen space. Second, it allows pilots to interact with menus using touch screens. The aim of this project is to offer pilots a safer and more intuitive interaction with their aircraft. By taking the advantages of touch-screen technology, a solution is created that could be easily integrated into different cockpit designs. The Touch Screen Control Unit concept is intended to replace many input devices in the cockpit. Instead of entering data with, for example, a keyboard or other input device, pilots can do so by touching the screen.

**Keywords:** Touch Screen; Navigation; Direct Manipulation; Gestures; Interface; Interaction

### Introduction

In general, a direct manipulation interface (DMI) is an interface that has the objective to give the administrator the inclination that the individual in question is directly connecting with the items taken care of through the interface (Hutchins et al., 1986). In addition to other things, this sensation of directness is principally made by utilizing certifiable illustrations of the items taken care of. For instance, controlling the state of a triangle is a lot simpler to do when the client can directly control (e.g., snap and drag) the control points of an apparent triangle as opposed to changing the triangle's directions in a network portrayal. Additionally, when pilots need to adjust their flight plan, repositioning the waypoints through directly associating with the visual portrayal of the waypoints on the route show is significantly more natural. The benefit of a DMI might be clear. That is, it can lighten the client from making mental interpretations between their activities and what is really being controlled. Be that as it may, current CDU and electronic showcases can't give such DMI functionalities.

The approach of touch-screen innovation, and specifically multi-touch, in purchaser hardware has plainly shown the upsides of direct manipulation ideas. Of course, some aeronautics producers have gotten these patterns and are (freely) chipping away at touchscreen swaps for the heritage CDU to work on the pilot's cooperation with the FMS.

In this paper we present a model touch screen control unit (TSCU) to possibly supplant the CDU. Uniquely in contrast to other touch-screen CDUs that fundamentally support single touches, the TSCU comprises of an excellent multi-touch screen that supports signals.



Figure

1: [https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.dynonavionics.com%2Fskyview-system.php&psig=AOvVaw2EWQBvzTPWlIPxH9jwTQde&ust=1631736704251000&source=images&cd=vfe&ved=2ahUKEwisp6GGo\\_yAhVDKysKHRNGB-cQr4kDegUIARClAQ](https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.dynonavionics.com%2Fskyview-system.php&psig=AOvVaw2EWQBvzTPWlIPxH9jwTQde&ust=1631736704251000&source=images&cd=vfe&ved=2ahUKEwisp6GGo_yAhVDKysKHRNGB-cQr4kDegUIARClAQ)

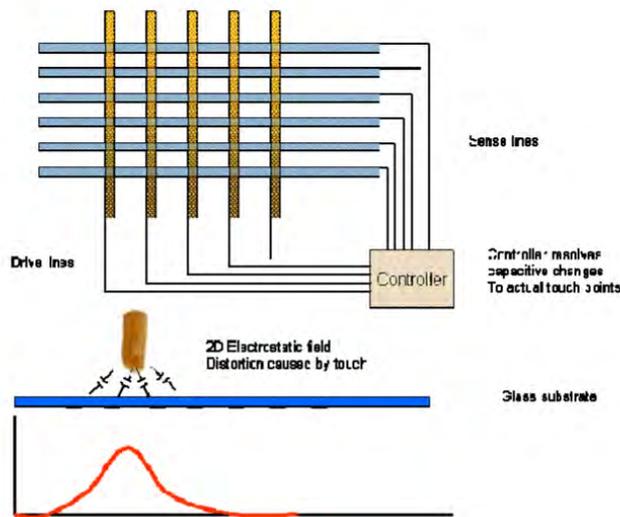


Figure 2: <https://sci-hub.se/https://doi.org/10.1117/12.919217>

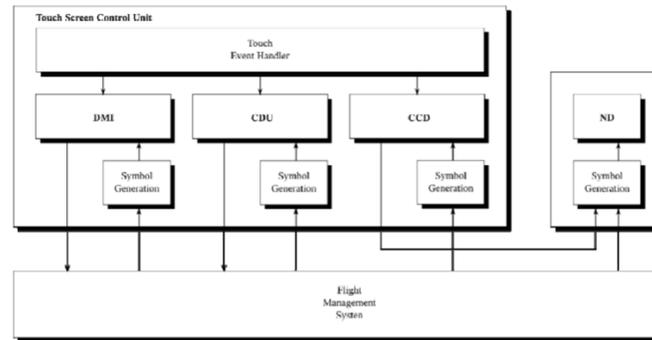


Figure 3: <https://sci-hub.se/https://doi.org/10.1117/12.919217>



Figure 4: [https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.aerospace-technology.com%2Fnews%2Fcollin-aerospace-x-59-quest-nasa%2F&psig=AOvVaw2EWQBvzTPWlIPxH9jwTQde&ust=1631736704251000&source=images&cd=vfe&ved=0CN8BEK-JA2oXChMlyKnDpqP\\_8gIVAAAAAB0AAAAAEAI](https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.aerospace-technology.com%2Fnews%2Fcollin-aerospace-x-59-quest-nasa%2F&psig=AOvVaw2EWQBvzTPWlIPxH9jwTQde&ust=1631736704251000&source=images&cd=vfe&ved=0CN8BEK-JA2oXChMlyKnDpqP_8gIVAAAAAB0AAAAAEAI)

## Future Scope

A new concept of interfacing in the cockpit will be developed. A Touch Screen Control Unit, allowing for a more intuitive Direct Manipulation Interface on its graphical representations, will replace the classic CDU. This concept not only improves the intuitiveness of the CDU functionality but also opens the path for more applications on the same surface. Adding a new functionality in the cockpit will basically result in a SW upgrade and does not require the installation of new equipment.

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## Long Range and Navigation

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### Abstract

LORAN is the long range navigation system, where the signals are transmitted hyperbolically. The time differential method is used to analyze the position of the object and the system as a whole follows the master-slave philosophy, due to the requirement of time synchronization. LORAN-C (low frequency signals of about 100kHz) was being used in navigation, and was a blessing for the planes and ships during bad weather in the time of the world war. eLoran is an independent hyperbolic navigation system which complements the GNSS giving the 2D position, time and navigation.

### Key Words

Long range, navigation, world war, low frequency, hyperbolic navigation, master-slave system, time synchronization



Fig1: Shows one of the many existing loran stations [1]

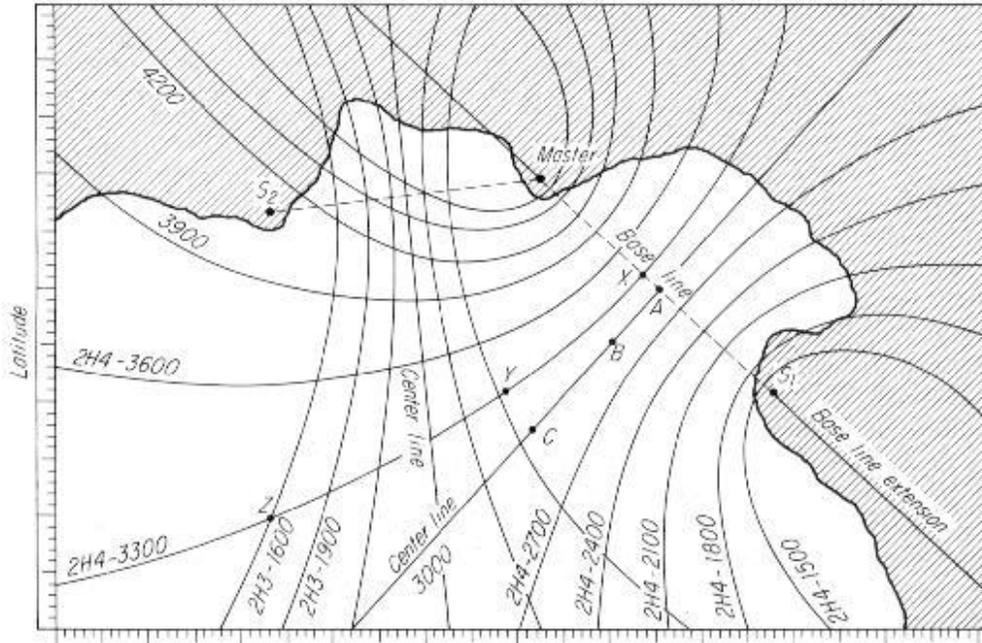


Fig 2.A sample Loran chart showing the location of a master and two slave stations. Also shown are station identifiers and time differences on the curves.[2]

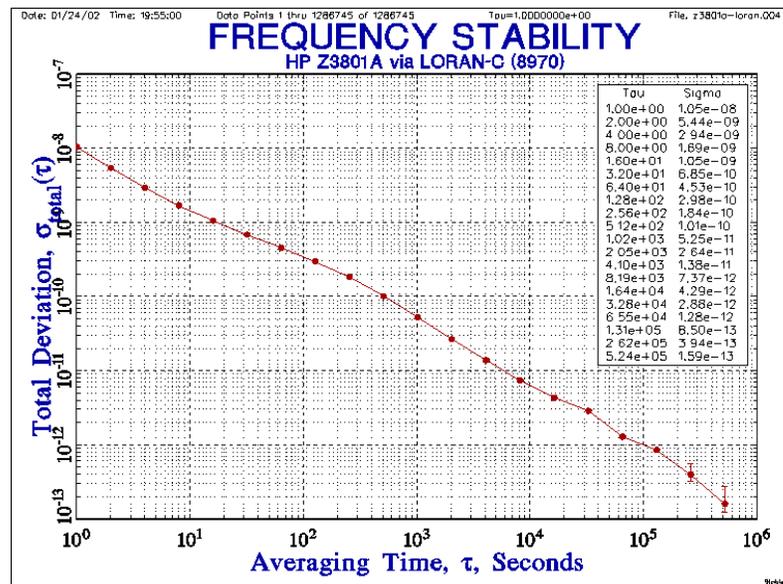


Fig 3:Frequency Measuring Capability[3]

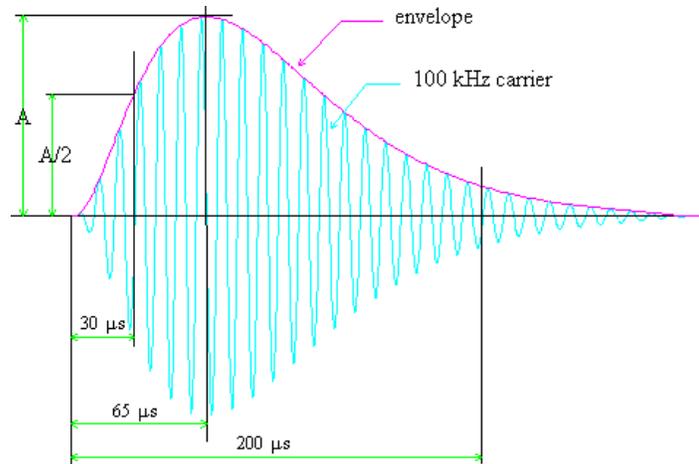


Fig 4 : Basic Pulse of LORAN [4]

Table 1-LORAN C [5]

	Loran-C Issue	Solution
Accuracy	Old timing clocks	New Cesium clocks
	Old timing equipment	New timing suite
	UTC Synch	New timing suite with tighter control
Availability	Brief Power loss	UPS
	Tube overloads	New SSX
Integrity	Bad timing	ABS
Continuity	Brief Off-air	New switch cabinets/UPS
	Tube overloads	New SSX

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## DME NAVIGATION SYSTEM

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### INTRODUCTION

Today, DME technology is revolutionizing the aviation world, bringing us to the next level of navigation technology. By emulating the way interconnected system functions, DME enabled machines are now trained to provide accurate measurements of the distance of the aircraft. In this abstract, the aim is to provide useful information about the DME navigation system, latest innovations and future developments.

This study explores the importance of DME navigation systems in the aviation industry. The term DME stands for Distance Measuring Equipment used for navigation purposes. The distance measuring equipment is a radio navigation aid technology that measures the slant range between an aircraft and ground station. In radar sensing slant range is the line of sight distance along a slant direction between two points that are not at the same level relative to a specific datum. This system ensures that the distance is measured by timing the propagation delay ( i.e. the length of the time taken for a signal to reach its destination) of radio signals in the given frequency band. An important parameter for the proper working of the system is that the aircraft and the ground station should be maintained in line of visibility.

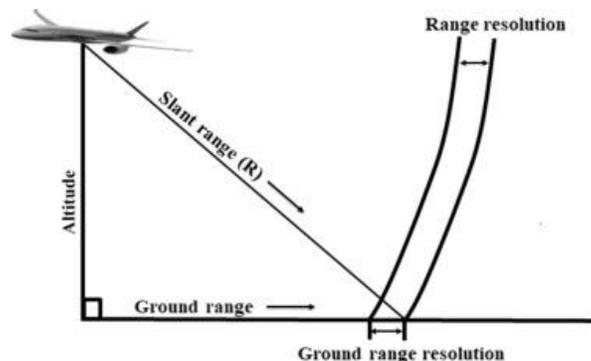


FIG:1.0

<https://ars.els-cdn.com/content/image/3-s2.0-B9780128181119000082-f08-08-9780128181119.jpg>

The basic working principle of DME systems is:

When a signal is sent by the aircraft onboard known as interrogator, the onboard DME starts counting the time until it gets a reply from the ground station. The resulting time depends upon the distance,

propagation speed, and signal reflections. The DME ground station transponders generate replies and send them back to the aircraft. The time interval between interrogation emission and reply reception provides the aircraft with the real distance information from the ground station. The frequency range for the DME system is UHF: 960 MHz to 1251MHz, consisting of 22 channels separated by 1MHz. While the ground station frequency answer is always: interrogator frequency +/- 63 MHz.

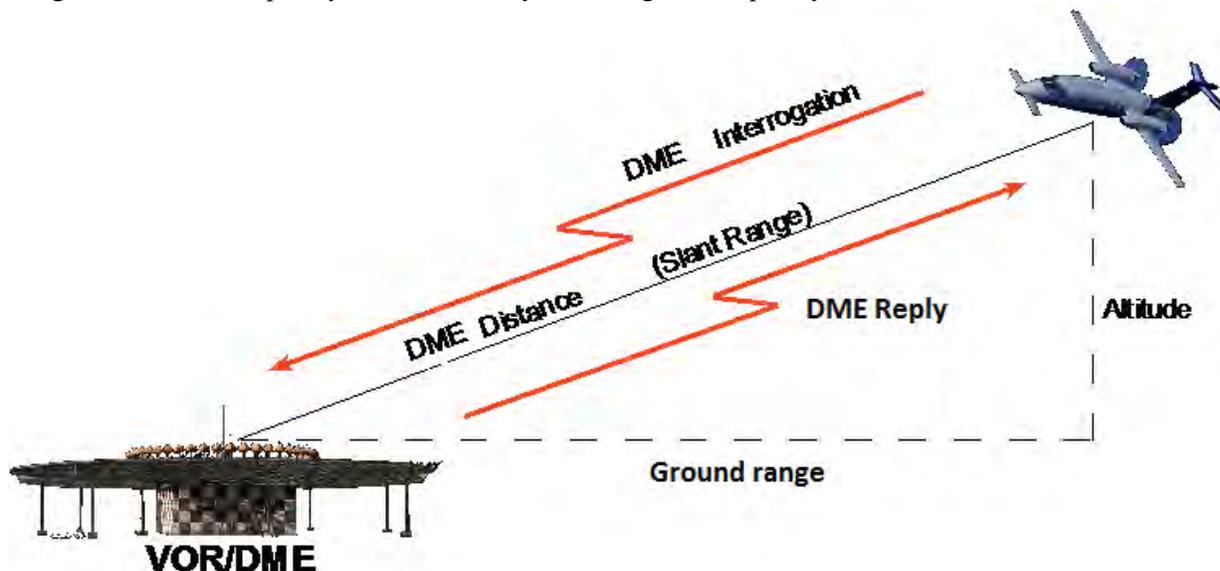


FIG 2.0

<https://substance.etsmtl.ca/wp-content/uploads/2014/09/figure-3.ven-.png>

The DME coverage is limited by the line of sight, if there isn't a line of sight between the emitter and the receiver there will not be a communication link. This is challenging for DME systems.

The equipment used in the DME system are: the ground-based DME transmitter which is usually coupled with a VHF omnidirectional radio range i.e. VOR (very high-frequency omnidirectional range), DVOR (Doppler very high-frequency omnidirectional range), or CVOR (conventional very high-frequency omnidirectional range), instrument landing gear (ILS), non directional beacon and many other instruments.

This system is fuel-efficient resulting in less energy consumption and better use of resources. It is an extremely accurate system providing accurate slant distance measurements. The coverage provided by this system is 20NM which is quite good. This navigation system has made navigation for the aviation industry easier and much more accurate. This has worked as a boon in the navigation department.

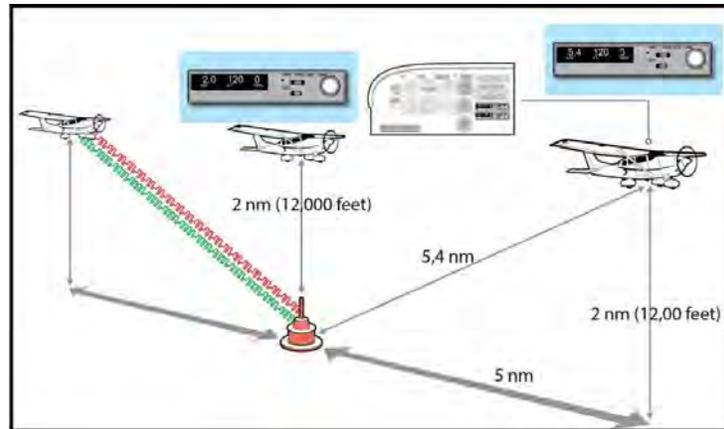


FIG 3.0

[https://www.aopa.org/-/media/Images/AOPA-Main/News-and-Media/Publications/Flight-Training-Magazine/1801f/1801f\\_hiw/1801f\\_hiw\\_16x9.jpg?h=675&w=1200&la=en&hash=29677DFDB73BDA45163220517ED46DD4](https://www.aopa.org/-/media/Images/AOPA-Main/News-and-Media/Publications/Flight-Training-Magazine/1801f/1801f_hiw/1801f_hiw_16x9.jpg?h=675&w=1200&la=en&hash=29677DFDB73BDA45163220517ED46DD4)

#### FUTURE SCOPE

The DME technology system is not as popular among the pilots as it was earlier. The revolution of the global positioning system has somehow out shadowed this technology. Though this system is required for some of the instruments used in the aircraft. The DME-RNAV, which is a feature of the flight management system on many jets and transport aircraft, is still used by various airlines.

Keywords: slant range, propagation delay, interrogator, propagation speed, transponders, omnidirectional, aviation, line of sight.

## Dr. Huson Predicts Comet will Destroy the Earth in 1911

by cvannoy (2021 October 30) (with permission)

<https://sheridanmedia.com/news/89852/dr-huson-predicts-comet-will-destroy-the-earth-in-1911/>



*The End Is Coming Says Dr. Huson The Earth Might Be Smashed Into Smithereens By The Rapidly Approaching Comets*, was a headline in the Nov. 7, 1911 Sheridan Daily Enterprise. *The Daily Enterprise* this morning was in receipt of a communication from Dr. Huson of Clearmont, in which a prediction is made that the end of the earth will come in the near future when two comets which are rapidly traveling toward each other will collide either with the earth or each other, the impact in each case being sufficient to knock the world into smithereens.

Dr. Huson has practiced medicine in Johnson county for many years and is said to have given much thought to the subject of astronomy. Clearmont was originally named after Dr. Huson but in later years the people saw fit to change the name.

Dr. Huson predicted the end of the world at the time of the visitation of Halley's comet eighteen months ago. He stated that the earth would become so tangled with the comet's tail that every living thing on it would meet its doom.

The communication from Dr. Huson in full is as follows: Clearmont, Wyo, Nov. 5, 1911. To the Daily Enterprise, Sheridan, Wyo. Please publish this in your paper. What has become of the astronomers? Two comets are visible to the naked eye, one in the east and one in the west. It can be seen in the east at 5 o'clock in the morning, and not a word from our astronomers. Wake up.. you scientific men, and tell what of the sign of the times. I predicted these comets coming to the earth one year and seven months ago. They have no direct path of their own and are coming directly toward the earth. No planet to influence their course. Let the world wake up. DR. E. W. HUSON.

## Dr. Huson Predicts Comet will Destroy the Earth in 1911

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*Huson house Clearmont Historical Group*

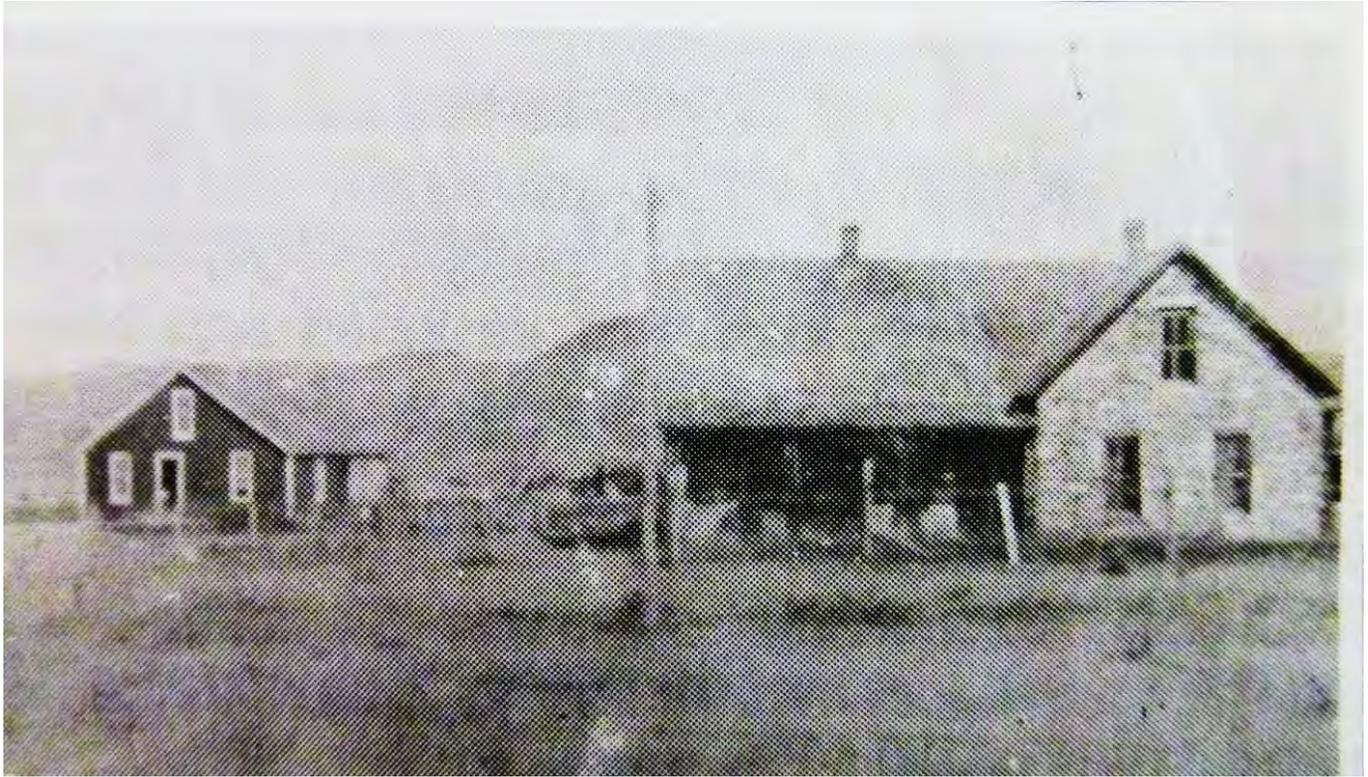
The Sheridan Post, October 17, 1911 *“Did you see a comet Tuesday evening?”* asked A L. Cummlngs, the well known musician and tuner of pianos, yesterday *“From Buffalo.”* he continued, it could be plainly discerned I noticed it about 7 o’clock. Tuesday, probably twenty degrees above the western horizon, and heard many people in Buffalo speak of it. While the tail was not so plain as that of Halley’s Comet, it appeared to be of great length and the phenomenon attracted considerable attention in Johnson county.”

Basin Republican, October 27, 1911 **Brooks Comet.** *Each morning now in the eastern sky a good view can be had of Brooks comet. To see it to the best advantage it should be observed just before dawn, as the tall can be seen more plainly than when the sky begins to light up. The comet is much larger than Halley’s comet, visible a year ago.*

Brooks comet was discovered in July, 1911 by astronomer William Robert Brooks. It is notable being very bright and having a distinctive blue color. It was uniquely visible at the same time (mid October 1911) and in the same part of the sky as a second bright comet that had a bright golden-yellow appearance.

These were obviously the two comets that Huson saw, and felt they heralded the end of the world.

## Dr. Huson Predicts Comet will Destroy the Earth in 1911



*First Huson House Clearmont Historical Group*

For generations, people have been fascinated by and at the same time feared comets. There are many myths about comets bringing doom and destruction in their wake.

In the 1st century A.D., Pliny the Elder believed that comets were connected with political unrest and death. He described the comet's tails as "long hair" or "long beards."

In the 11th century Halley's Comet was believed to have foreshadowed the triumph of the Normans at the Battle of Hastings.

Halley's comet is probably the best known comet. It has been observed and recorded by astronomers since around 240 BC. It becomes visible from earth to the naked eye about every 75 years, and is the only comet that is known to appear at regular intervals. It appeared in 1910, and again in 1986. In 1705, astronomer Edmond Halley understood that the appearances every 75 years were the same comet, so the comet now bears his name.

The Upton Newsletter, January 7, 1910, had a long article the return of Halley's Comet. *Waiting for the return of Halley's Comet, after a lapse of over seventy-five years, is very much like waiting for a train. We know the track on which the train will speed toward us; but whether the train will be on time or not, we cannot know. We know the orbit of the comet but not the exact minute when it will swing around the sun.... Of all comets that have ever been discovered, Halley's is the most important, because it is the most historical. It flashed upon the world when Egypt was young and when Greece was a wilderness inhabited by savages. Perhaps it will continue to return when mankind is old and decrepit, and the earth is entering that last tragic stage of its existence when it will be reduced to a cold, dead, desolate world....*

## Dr. Huson Predicts Comet will Destroy the Earth in 1911

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The next time Halley's Comet will come back near the earth will be in 2061, who knows what the earth will look like then?

In this article in the Sheridan Daily Enterprise on May 19, 1910 including clips from other papers nationwide.

### **Halley's Comet Passed With No Demonstration. Noted scientists say great comet's tail will not effect the earth's peace**

*Foreigners Frightened. Chicago, May 19.*— In districts of Chicago populated by foreigners school children by the hundreds yesterday asked permission of their teachers to remain at home today for fear of some untoward happening for which Halley's comet may be responsible. Physicians were appealed to by their patients for specifics to ward off the dangerous gases which they suppose will envelop the earth when it passes through the comet's tail. Priests and ministers were besought by their parishioners for words of comfort to help them through the ordeal through which they believe they are about to pass.

*Princeton, May 19.* — The failure of the earth to plunge through the comet's tail as expected last night, is believed by astronomers at Princeton university to be due to the pronounced curve the tail developed.

*Williams Bay, Wis., May 19.*—Setting at variance all scientific figures and predictions and dumbfounding the astronomers at the Yerkes observatory here, the tail of Halley's comet was plainly visible in the east just before daybreak today. No satisfactory explanation of the phenomena is offered. Three explanations have been suggested, however. First, the curvature of the tail may be greater than supposed; second, like the comet of 1903, Halley's Comet may have a creased tail, and third, it is possible all calculations were wrong, and the comet has not yet passed the earth.

There were other concerns if the earth passed through the tail of Halley's comet, as is evidenced by the Hulett Inter Mountain Globe, August 24, 1911.

*Prof. H Alfred Mitchell, In N. Y. World.* Just about one year ago Halley's comet was the great center of interest and night after night, in the early days of June. It was watched with pleasure by hundreds of thousands of people. And now, after one-seventy fifth of it's journey about the sun has been run, the comet is still visible, not to the naked eye but through powerful telescopes. A few days ago Prof. K. P. Whitman, who holds the chair of astronomy at Western Reserve University, advanced the theory that Halley's comet may have had something to do with the recent hot wave which stretched across the country. His theory is that part of the comet's red hot, fiery tail was still cavorting about somewhere near Mother Earth and had increased the temperature abnormally all over the world.

Comets are cosmic snowballs, made up of frozen gases, rock and dust. When a comet's orbit brings it close to the sun, it heats up and the dust and gases form a tail, or a "beard" that stretches out behind the comet's head for millions of miles.

The Upton Newsletter put it this way. *The luminous tail which streams behind the nucleus, and which Milton regarded as "horrid hair" that "shakes pestilence and war," is startling, to say the least.*

*After the comet was no longer visible, people began to relax.*

# Dr. Huson Predicts Comet will Destroy the Earth in 1911

In the Buffalo Bulletin on May 19, 1910 And here it is the 19th and the comet hasn't hit us yet.

Why the fear? Why was Dr. Huson worried enough to send a letter to the newspaper warning people about the possible end of the world? Could it be, like some authors believe, that at one time before the written history of man, a comet did hit the earth, and cause a great catastrophe on earth.

*Yesterday*

**Edward Wing Huson: "Doc" of all trades**

Edward Huson was born in Boston, NY 1832. By age ten, he was apprenticing to gain skills in medicine and pharmaceuticals. Edward continued apprenticing when his family moved west – first to Wisconsin, then Iowa. He soon became called "Doc", and was known for setting a broken bone by moving it until it felt straight, splinting it, and prescribing rest for 21 days.

Doc contracted typhoid fever, so in 1880 moved further west with the family to a drier climate. Buffalo, Wyoming became home. In April of 1891, the Husons moved for the last time. Doc's first project was to build the two-story rock home before which you stand today.



E.W. "Doc" Huson and his wife, Clarissa Pettingill Huson were married in 1862. Mrs. Huson was a strong pioneer lady who raised 16 children during their marriage.





The masthead of Huson's weekly newspaper. Below, advertising from September 1892.

**J.T. Brown's General Store** where the poor man has a chance and the rich man an opportunity.

**The Merchant's Hotel** – Plenty of beds and abundant bedding. Rates: \$1.50/day; Tickets good for 21 meals, \$5.00; Single meals 85 cents.



The Huson homestead sits on 528 conserved acres. Nearly half of this property consists of sagebrush steppe and grassland, which is prime habitat for sage grouse. Migrating waterfowl also use the riparian habitat along Clear and Ulm Creeks.

**Huson's final chapter**

Doc knew the railroad would head through Sheridan, so he planned a town along the way called Huson. Huson would also become the stop for the Cheyenne-Deadwood stagecoach.

Talk of the railroad town spread quickly. By fall of 1892, Huson was a full-fledged town with 200 residents, 30 businesses, and a 4-page newspaper, *The Northern Wyoming Stinger*.

Despite optimism, the town died quickly. After seven short months, the town abandoned Huson and continued instead to Clearmont.

Information board at the Old Huson House

In fact, new evidence found in sediments show that approximately 13,000 years ago, there may have been a massive explosion, possibly caused by a comet. This explosion was larger than the Tunguska event in Siberia in 1908, that kicked in a massive global cooling and caused the end to the Clovis culture in North America.

Is this somehow a part of our genetic memory? Perhaps, at one time, there was a reason to worry about Halley's comet, or other comets. Who really knows?

But Dr Huson, Clearmont, Wyoming, predicted that the two comets would, indeed, bring about the end of the world in 1911.

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



(Nov. 1) Starbase | Gateway to Mars



(Nov 15) Look: SpaceX Photo Reveals Starship Static Fire Test



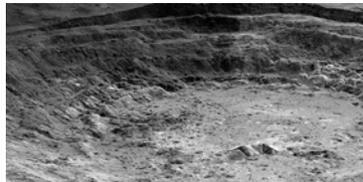
(Nov. 17) SpaceX Is About to Launch Its Biggest Rocket Ever



(Nov. 18) Bezos' Blue Origin, in lost NASA lawsuit, raised offer to cover \$3 billion in lunar lander costs



(Nov. 4) Blue Origin loses federal lawsuit over NASA moon lander contract



(Nov. 10) The Moon's top layer alone has enough oxygen to sustain 8 billion people for 100,000 years



(Nov. 18) Elon Musk said SpaceX will fly its Starship spaceship into orbit for the first time in January, but warned the first attempt might not be a success



(Nov. 20) Rolls-Royce claims to have developed the world's fastest all-electric aircraft



(Nov. 23) Will hydrogen energy help decarbonise the economy?



(Nov. 24) Plug Power Selected by Fertigllobe's Green Hydrogen Consortium to Deliver 100MW Electrolyzer for Green Ammonia



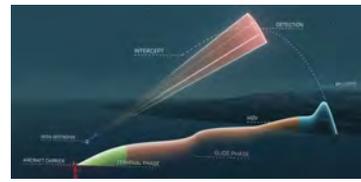
(Nov. 2) Is green hydrogen the answer to the climate crisis? | DW Documentary



(Nov. 18) New Electric Propulsion Engine For Spacecraft Test-Fired in Orbit For First Time



(Nov. 22) A Chinese hypersonic weapon that alarmed top US military leaders fired something off as it sped toward its target



(Nov. 23) US Selects Top Defense Firms To Develop New Interceptor System That Can Kill 'Chinese, Russian' Hypersonic Arsenal



(Nov. 3) Did Northrop Grumman Just Show Off A 6th Generation Stealth Fighter?



(Nov. 18) Taiwan deploys advanced F-16V fighter jets amid China threat



(Nov. 25) Taiwan Commissions 64 Locally Modernised F-16V Fighters With New AESA Radars



(Nov. 21) NASA and Lockheed Martin hope to bring back commercial supersonic travel



(Apr. 20) Could Japan Revive the YF-23 Black Widow II?



(Nov. 24) Verizon and AT&T offer to temporarily lower 5G's power to avoid aircraft interference

# Photography Gallery: The Moon and The Three Planets (Ms. Michelle Evans)

## 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/>

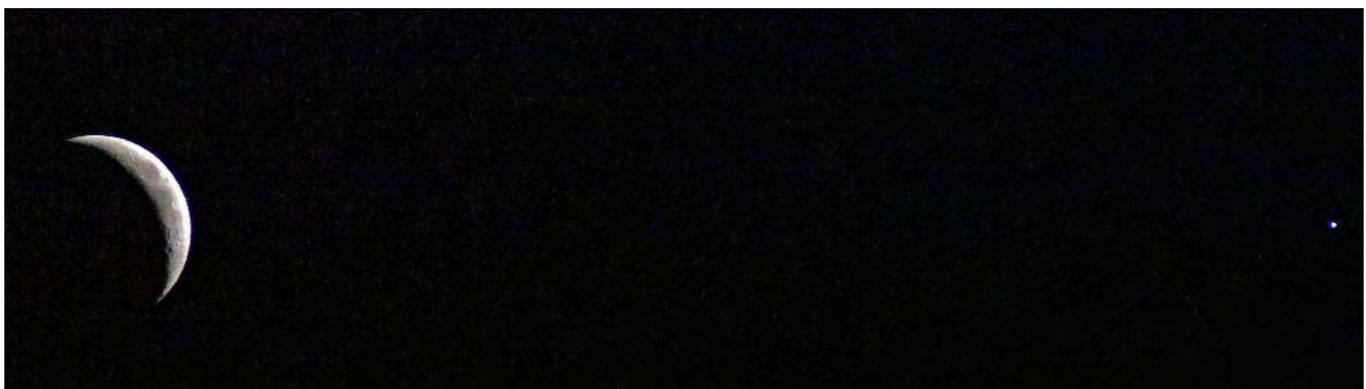
*Speaker of Several AIAA LA-LV Section Meetings, such as April 10, 2021 STS-1 40th Anniversary*

<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/>

<https://earthsky.org/tonight/moon-saturn-jupiter-november-9-10-and-11-2021/> (more information)



*The Moon next to Venus, from Sunday, 8 November, taken at 5:20 pm PST. The readers can compare it to the one posted in October (see below) of the Moon and Venus to see how much closer they were together this month. The photo was taken at 300mm at 1/250th second exposure.*



*This photo of the Moon and Venus was taken at 1/4000th of a second exposure at 300mm at 7:11 pm on Saturday, October 9th from Lake Forest, CA.*

*Please Zoom in or download the images to zoom in further from*

<https://conta.cc/30ydZq1>

## Photography Gallery: The Moon and The Three Planets (Ms. Michelle Evans)



*Another photo of the Moon and Venus on Sunday, 8 November, which has the Moon overexposed so that the readers can see the rest of the disk in Earthlight, along with the blue still in the sky and a tree in the foreground. This was taken at 1/90th of a second at 240mm at 5:21 pm on the 8th of November.*

## Photography Gallery: The Moon and The Three Planets (Ms. Michelle Evans)

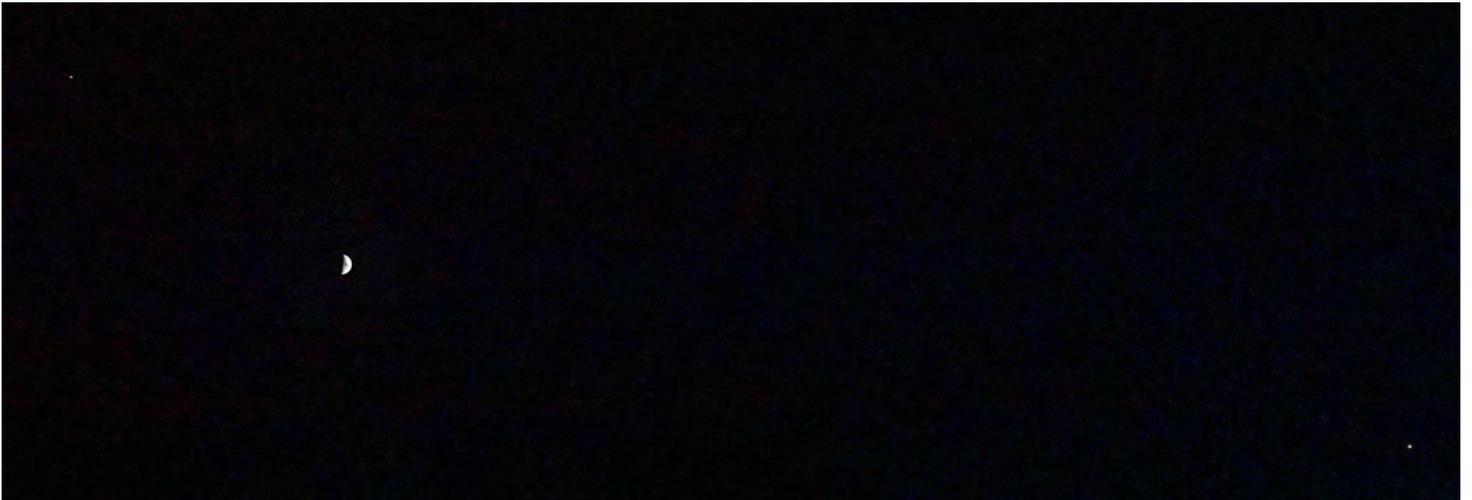


*Ms. Evans' shot from November 9th's conjunction of Venus and Jupiter, with the Moon stuck right in the middle. Actually Saturn is in there as well, but just too faint to pick up. This is a wide angle shot at 18mm at 1/60th of a second.*

## Photography Gallery: The Moon and The Three Planets (Ms. Michelle Evans)



*Jupiter, Moon, and Saturn make a triangle, shot at 70 mm and 1/45th of a second at 6:30 pm, on 10 November*



*Jupiter, Moon, and Venus shot at 18mm and 1/60th of a second at 6:33 pm on 10 November.*

## Photography Gallery: The Moon and The Three Planets (Ms. Michelle Evans)



*The closest image of the Moon and Jupiter, taken at 6:20 pm, 11 November, at 1/4000th of a second and 185 mm.*

## Photography Gallery: The Moon and The Three Planets (Ms. Michelle Evans)



*The Moon with Jupiter, but with a tree in the foreground. This was taken at 6:21 pm on 11 November at 1/60th of a second and 98 mm.*

## Photography Gallery: The Moon and The Three Planets (Ms. Michelle Evans)

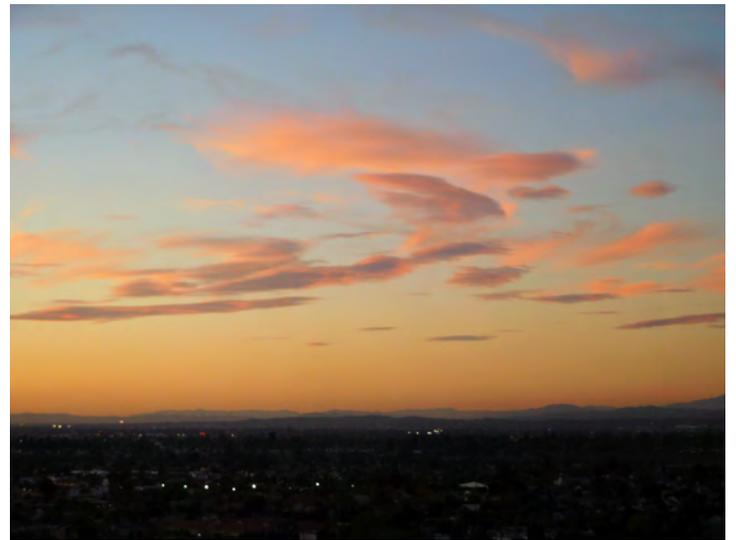


*The Moon and Jupiter are on the left, with Venus way over on the right side so the readers can compare how the Moon moved by the planets over those several days. This was taken at 1/125th of second at 23mm at 6:25 pm on 11 November.*

# Photography Gallery: Beautiful Sunset in Southern California on Nov. 26

(Ms. Michelle Evans, AIAA Distinguished Lecturer/Speaker)

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



*Beautiful Sunset in Southern California, at the Orange County Mining Company, on November 26.*

## Photography Gallery: Beautiful Sunset in Southern California on Nov. 26 (Ms. Michelle Evans)



*Michelle (right) and Cherie (left) Evans, at the Orange County Mining Company, on November 26.*

# Photography Gallery: Partial Lunar Eclipse (Dr. Henry B. Garrett)

## Dr. Henry B. Garrett

AIAA Fellow

Principal Scientist

OFFICE OF SAFETY AND MISSION SUCCESS

The Jet Propulsion Laboratory

California Institute of Technology

<https://www.aiaa-lalv.org/september-21-2020-aiaa-member-spotlight-on-dr-henry-b-garrett/>

Speaker of Several AIAA LA-LV Section Meetings, such as October 30, 2021 Space Debris Mitigation

<https://www.aiaa-lalv.org/2021-october-30-the-little-things-that-go-bump-in-the-night-space-debris-from-the-bottom-up-by-dr-henry-b-garrett/>



Photos of the different phases of the Partial Lunar Eclipse on November 19, 2021. Although the sky was cloudy early in the evening, it cleared about a half an hour before the main eclipse. Of note is that the pictures were taken using a mirror Dr. Garrett hand ground in 9th grade in 1963 and with the telescope he built.

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

**AIAA LA-LV 12/4 Section (Town Hall) e-Meeting (Online on Zoom)**

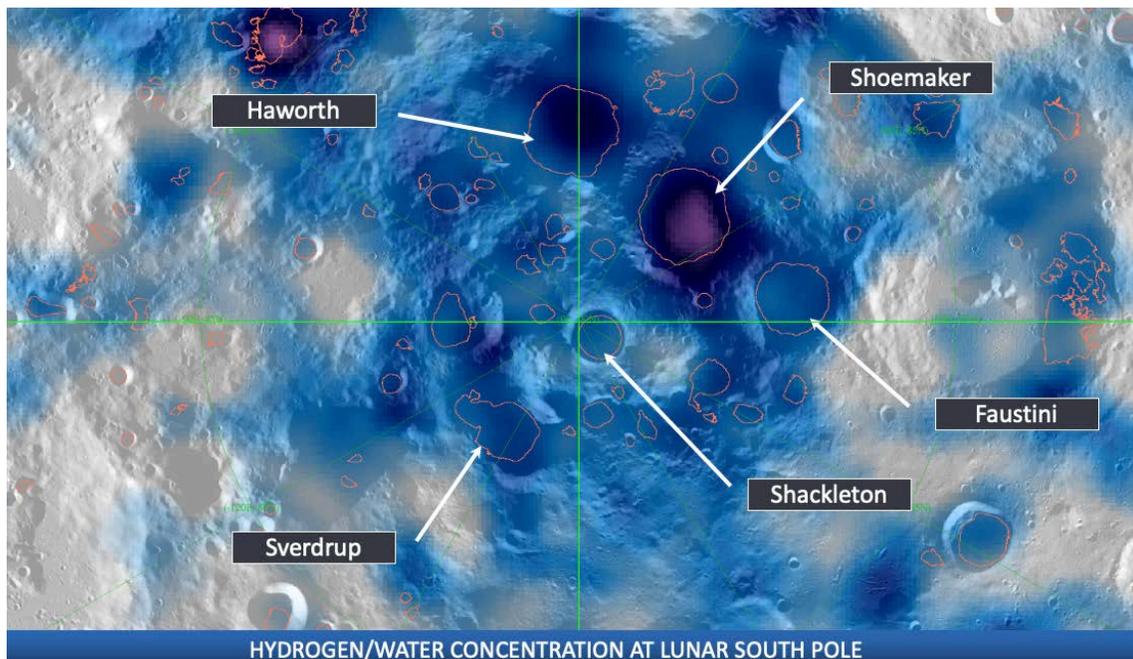
**Saturday, 2021 December 4, 11 AM PST (US and Canada)**

# ***The Exploration of the Moon and then onto Mars***

*by*

## ***Dr. James L. Green***

### ***NASA Chief Scientist***



*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](mailto:events.aiaalav@gmail.com))*

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

<https://www.eventbrite.com/e/aero-alumni-luncheon-apollo-17-anniversary-tickets-219705955427>

## AIAA LA-LV 12/15 Aero Alumni Meeting (Hybrid in-person/Zoom)

Wednesday, 2021 December 15, **11 AM PST** (US and Canada)

# *Aero Alumni Luncheon & Apollo 17 Anniversary*

Our monthly Aero Alumni Zoom meeting will be at 11 am December 15, (The 3rd Wednesday of December.) It will be a hybrid meeting (both in-person there and on-line) at the **Olive Garden in Torrance, 23442 Hawthorne Blvd.** There will be a presentation about the 49th anniversary of the last footsteps on the moon by Apollo 17 astronauts 49 years ago on that date.

Lunch menu of soup, salad, breadsticks, and coffee or fountain drink is \$20.00 to be pre-ordered in the RSVP below. Other options may be offered and updated if requested in the RSVP comments - prices TBD.



Please comply with the LA County Health Department requirements for vaccinations & masks for dining in person on Wednesday. (These are more lenient if you attend via Zoom. (-))

The link to the Zoom meeting is: Join Zoom Meeting

<https://aiaa.zoom.us/j/92210650563?pwd=NXBDRE1tUjU5dStjZDdrV1lWczRzQT09>

Meeting ID: 922 1065 0563 Passcode: 191138

One tap mobile

+16699009128,,94853393478# US (San Jose)

+12532158782,,94853393478# US (Tacoma)

Find your local number: <https://aiaa.zoom.us/j/92210650563>

Contact: Mr. Gary Moir, Technical Chair, AIAA LA-LV Section ([gary.moir@ingenuir.com](mailto:gary.moir@ingenuir.com))

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

AIAA LA-LV 12/15 Section (Town Hall) e-Meeting (Online on Zoom)

Wednesday, 2021 December 15, 7 PM PST (US and Canada)

## *Lunar Roving Adventures*

*Dust, Dust, Everywhere - What Are We Going To Do?*

by

**Mr. Ron Creel**

*Retired Space And Thermal Systems Engineer*

*Member of the Apollo Lunar Roving Vehicle (LRV) Team*

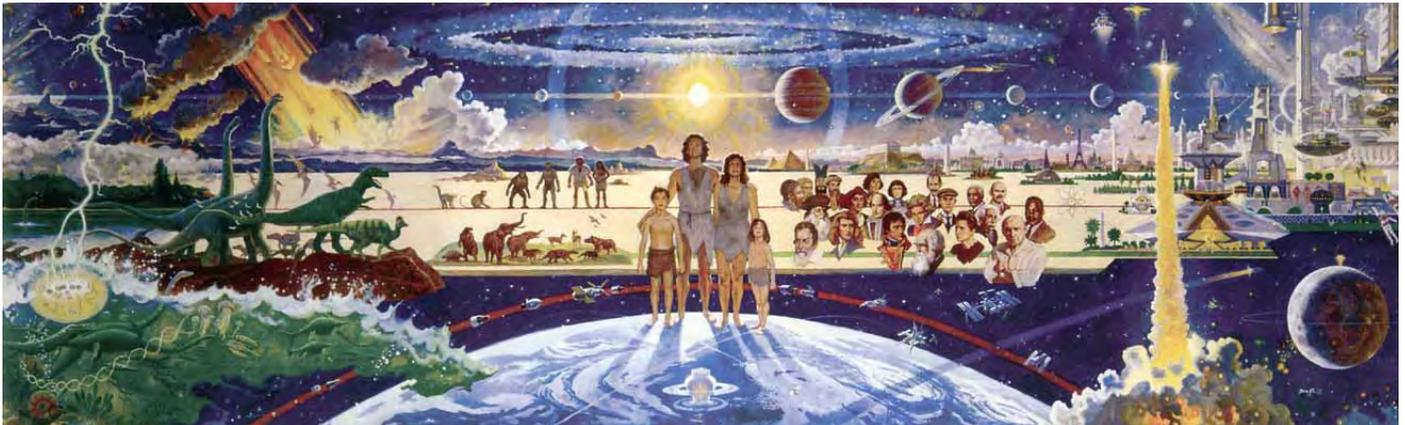


*Disclaimer: The views of the speakers do not represent the views of AIAA or the AIAA Los Angeles-Las Vegas Section. Contact: Dr. Ken Lui, Events/Program Chair, LA, AIAA LA-LV Section ([events.aiaalav@gmail.com](mailto:events.aiaalav@gmail.com))*

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

# AIAA LA-LV Space Philosophy Gathering

Saturday December 18<sup>th</sup>, 10:00am-2:00pm Pacific Standard Time, ONLINE



Philosophy deals with the fundamental nature of knowledge and seeks answers and meaning to the deep questions of our existence, nature, and the cosmos. Great philosophies underpin the activities of great civilizations. Philosophical thoughts and tenets precede visions and policies of nations that manifest as concepts and architectures that are vital to propel the progress engine for the continued sustenance of civilization.

Space philosophy shines light on the various dimensions of humanity's quest to interact with nature's most open, transparent, and spacious physical domain; to explore, settle, and engage not only our nation or established allies, but to extend our collaboration, find common meaning, and enhance and enrich our common humanity across the globe, for the benefit and betterment of all.

Space philosophy, through what we know from the very short span our species has directly engaged our planet from without, continues to refine our species sensitivity, offering new insight and perspectives into our inextricable links with the biosphere, making us more aware of our place in the cosmos and the unique planet we call Mother Earth. Outer space activities continue to provide unbounded inspiration and nourishment for the soul of humanity through the sheer awe and wonder we experience while our curiosity impels us to pursue ever more complex operations in this domain.

By design, space activities and technologies are very conscious of resources, and space operations continue to pursue ever cleaner, ecologically sensitive awareness and frugal approaches that are finding their way into dwellings and cities on Earth. Our esteemed group of speakers and panelists from around the globe presented various dimensions and points of view on space philosophy.

August Space Philosophy here: [AIAA LA LV Space Philosophy Gathering 2021 August 14 - YouTube](#)

A common theme that resonated throughout the day-long event was that our species and our biosphere and our view and place in the cosmos are inextricably linked. And that we should continue to use our species-unique imaginative faculties and creativity that have served us well to progress the use of tools of technology to become more aware and more sensitive to our surroundings. The messages conveyed suggest that we act collectively in a manner that responds to nature benevolently, starting from caring for our immediate Earthly nature and environment. And space activity, human space activity in particular, is helping to make us better stewards of spaceship earth, or more appropriately, Mother Earth.

The overwhelming support for the August event now has accumulated a lineup of speakers who will present their views in the next edition of this program around Christmas time. One more way to enjoy the holidays!

*We shall not cease from exploration  
And the end of all our exploring  
Will be to arrive where we started  
And know the place for the first time.*  
T. S. Eliot (Little Gidding, 1942)

**Speakers and Agenda to be announced**

**Moderated by Madhu**

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