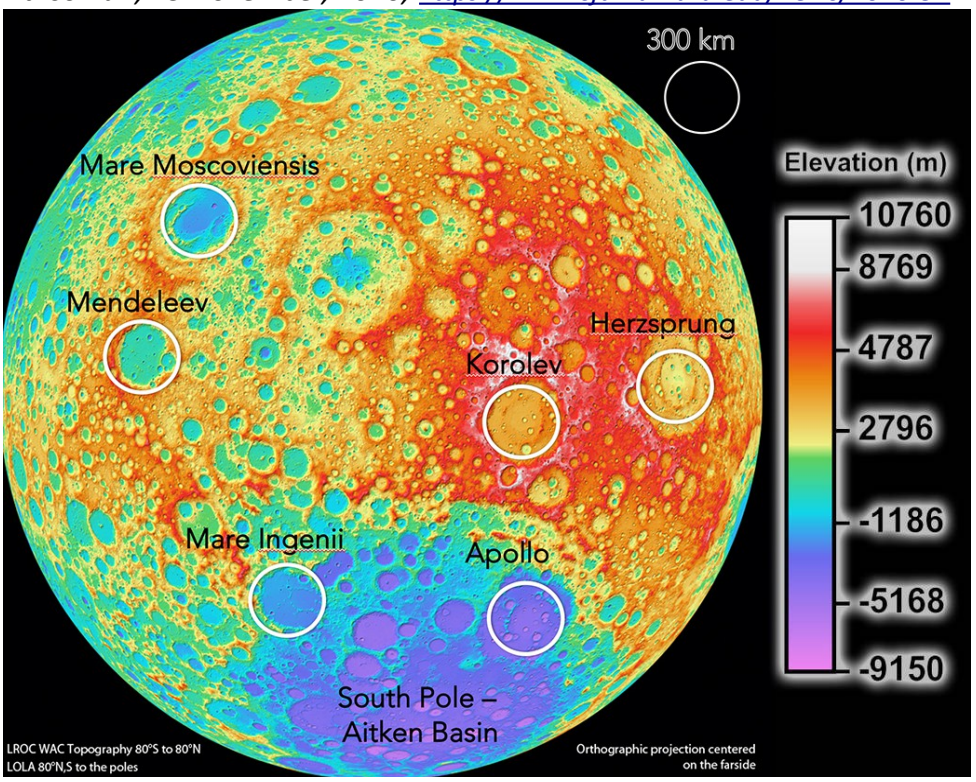
AIAA American Institute of Aeronautics and Astronautics Los Angeles - Las Vegas Section

Newsletter

Growing Interest in Moon Resources Could Cause Tension, Scientists Find

by Center for Astrophysics | Harvard & Smithsonian, 23 November, 2020, https://www.cfa.harvard.edu/news/2020-31



(Right) Taken by NASA's Lunar Reconnaissance Orbiter, this image of the moon is part of the collection of the highest resolution, near-global topographic maps of the moon ever created. Overlaid on this image are some of the hotspots identified for cosmology telescopes on the moon; few ideal locations for these telescopes exist on the moon, as others conflict with the radio quiet zone.

Credit: NASA/Goddard Space Flight Center / DLR / ASU; Overlay: M. Elvis, A. Krosilowski, T. Milligan

Cambridge, MA - An international team of scientists led by the Center for Astrophysics | Harvard & Smithsonian, has identified a problem with the growing interest in extractable resources on the moon: there aren't enough of them to go around. With no international policies or agreements to decide "who gets what from where," scientists believe tensions, overcrowding, and quick exhaustion of resources to be one possible future for moon mining projects. The paper published today in the Philosophical Transactions of the Royal Society A.

"A lot of people think of space as a place of peace and harmony between nations. The problem is there's no law to regulate who gets to use the resources, and there are a significant number of space agencies and others in the private sector that aim to land on the moon within the next five years," said Martin Elvis, astronomer at the Center for Astrophysics | Harvard & Smithsonian and the lead author on the paper. "We looked at all the maps of the Moon we could find and found that not very many places had resources of interest, and those that did were very small. That creates a lot of room for conflict over certain resources."

(Continued on Page 20)

December 2020 Click title to go to article

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Has the UAV defined the modern battlespace?

The Possibility of Controlling GPS Accuracy in Global Hotspots Could be an Important Advance in halting the proliferation of accurate lethal drones

by Dr. Stephen Bryen, Former Deputy Under Secretary of Defense (with Permission), 8 December, 2020

https://www.bryensblog.com/has-the-uav-defined-the-modern-battlespace, https://youtu.be/Eg0L8doC8kk

The Nagorno Karabakh war's lessons are still being learned but it is obvious that UAVs or drones played a huge role in the defeat of Armenian and Armenian-proxy forces.

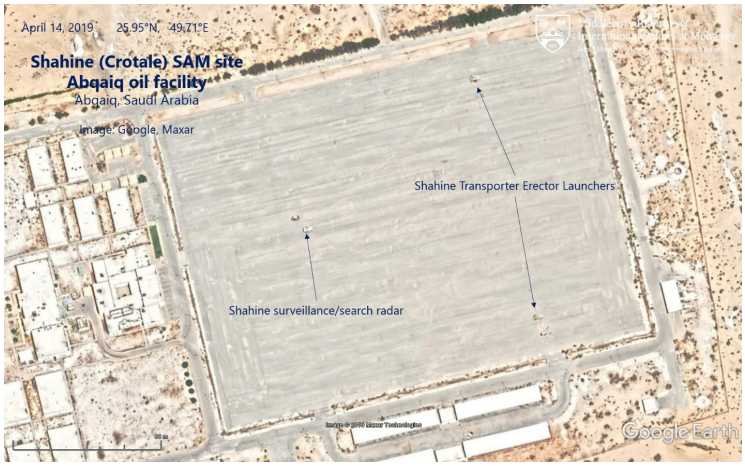
Battlefield results show that Azerbaijani forces took out 241 Armenian main battle tanks (T-72's and T-90s), 50 BMD infantry fighting vehicles, 17 motorized artillery pieces, 9 radars, 2 SMERSH MLRS systems, 70 GRAD MLRS systems and a large number of vehicles including trucks.

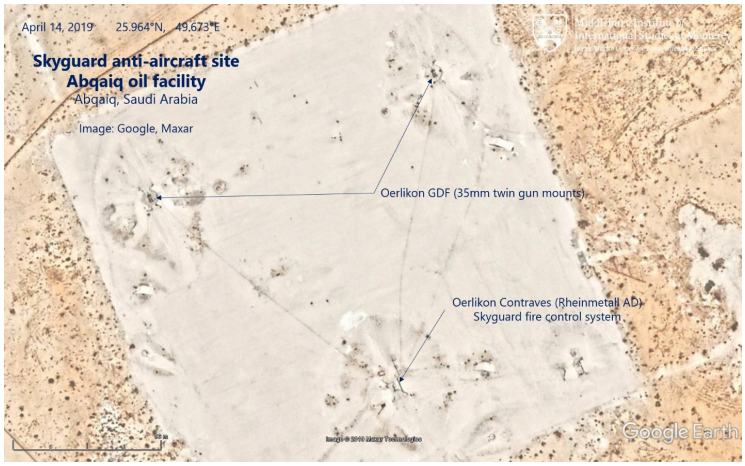
But the most surprising result was the destruction of Armenian Air Defenses. Four S-300 air defense systems were knocked out; 3 TOR tracked air defense missile systems; 40 OSA 9K33 tactical air defense systems and 5 KUB 2K12 medium range air defense systems. As a result, virtually all of Armenia's air defense systems were destroyed, leaving Armenian forces only with hand held MANPAD's for air defense.

In the many videos provided by Azerbaijan taken from surveillance drones or from the attack drone itself, there is no evidence that any Armenian radar or air defense system detected the attacking UAV or the accompanying observation drone before it was hit and destroyed. In the videos you actually see radar dishes turning as they are struck by UAVs.

This is not entirely new. In the September, 2019 attack on two Saudi Arabian oil facilities at Abqaiq and Khurais, none of the Saudi air defenses detected the drone and cruise missile attacks.

In Saudi Arabia there were three systems guarding the oil fields and refining plants: the US-supplied Patriot, the Shashine Surface-to-Air Missile (SAM) system (France) and Oerlikon's (Swiss) GDF radar-guided 35 mm twin air defense cannons. Shashine and Oerlikon systems were installed on the perimeter of Abqaiq and Khurais. (The photos below were taken in 2019 and can be found in the Report of the UN-commissioned Panel of Experts.)

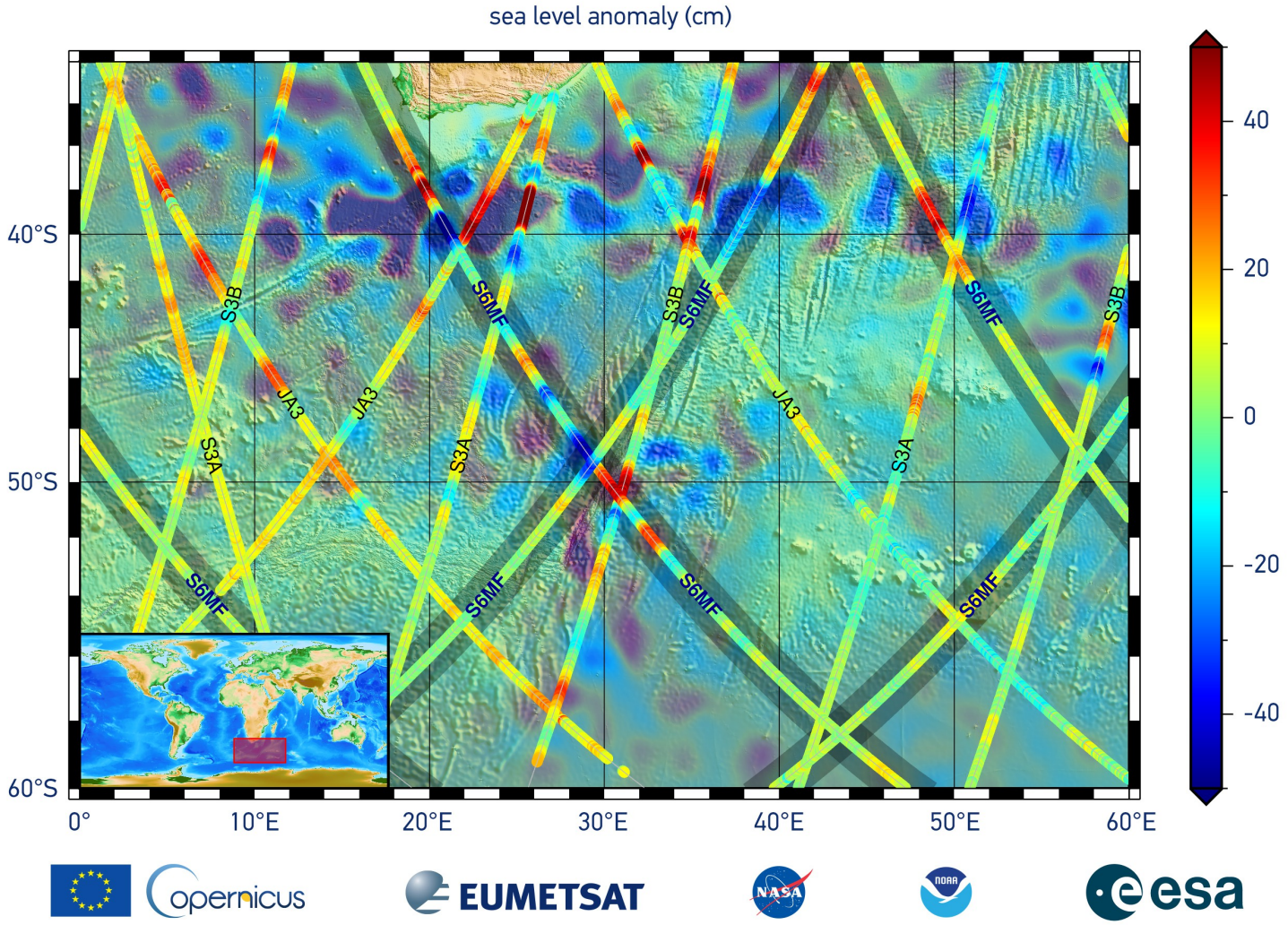




(Continued on Page 22)

NASA, US, European Partner Satellite Returns First Sea Level Measurements *(10 December, 2020)*

https://www.nasa.gov/press-release/nasa-us-european-partner-satellite-returns-first-sea-level-measurements



The data in this graphic are the first sea surface height measurements from the Sentinel-6 Michael Freilich (S6MF) satellite, which launched Nov. 21, 2020. They show the ocean off the southern tip of Africa, with red colors indicating higher sea level relative to blue areas, which are lower. Credits: EUMETSAT

Sentinel-6 Michael Freilich, a joint U.S.-European satellite built to measure global sea surface height, has sent back its first measurements of sea level. The data provide information on sea surface height, wave height, and wind speed off the southern tip of Africa.

"We're excited for Sentinel-6 Michael Freilich to begin its critical work studying sea level and helping us understand the many aspects of our planet's global ocean," said Thomas Zurbuchen, NASA's associate administrator for science at the agency's headquarters in Washington. "I know Mike would be thrilled that the satellite bearing his name has begun operating, but he'd also be looking forward to studying the data from this important mission, as we all are."

Since the successful Nov. 21 launch from Vandenberg Air Force Base in California aboard a Space-X Falcon 9 rocket, engineers and scientists have spent several weeks switching on and checking out the satellite and its instruments, making sure everything is operating as it should.

"Christmas came early this year," said Josh Willis, project scientist at NASA's Jet Propulsion Laboratory in Southern California. "And right out of the box, the data look fantastic."

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NASA Administrator Statement on Passing of Gen. Chuck Yeager

https://www.nasa.gov/press-release/nasa-administrator-statement-on-passing-of-gen-chuck-yeager (7 December, 2020)

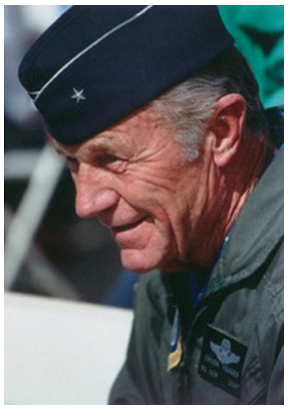


Photo of Chuck Yeager, taken in the 1990s. In 1947, Yeager became the first pilot to fly faster than the speed of sound. Credits: Air Force Test Center History Office

The following is a statement from NASA Administrator Jim Bridenstine on the passing of Gen. Chuck Yeager:

"Today's passing of Gen. Chuck Yeager is a tremendous loss to our nation. Gen. Yeager's pioneering and innovative spirit advanced America's abilities in the sky and set our nation's dreams soaring into the jet age and the space age. He said, 'You don't concentrate on risks. You concentrate on results. No risk is too great to prevent the necessary job from getting done.'

"Among many firsts in more than 60 years in aviation, Chuck was the first man to fly at the speed of sound, and his achievements rival any of our greatest firsts in space. Not content to rest on his laurels, he went on to break his own record and travel at Mach 2.44. But even before that he was serving his country heroically in World War II. Long after he became a legend in his own time, he continued to serve his country through the military and later in his ongoing work to test new aircraft.

"Chuck's bravery and accomplishments are a testament to the enduring strength that made him a true American original, and NASA's Aeronautics work owes much to his brilliant contributions to aerospace science. As a young naval aviator, I was one of many around the world who looked up to Chuck Yeager and his amazing feats as a test pilot. His path blazed a trail for anyone who wanted to push the limits of human potential, and his achievements will guide us for generations to come."

Yeager in front of the Bell X-1, which, as with all of the aircraft assigned to him, he named Glamorous Glennis (or some variation thereof), after his wife. (From Wikipedia)

Yeager, as Commandant of the USAF Aerospace Research Pilot School with a model of the North American X-15, 1959 (From Wikipedia)

Hamas aims precision cruise missiles at Israel

Israeli leaders are accused of covering up Iran-backed militant group's new possession of advanced missiles and cluster bombs

by Dr. Stephen Bryen, Former Deputy Under Secretary of Defense (with Permission), 1 December, 2020)

https://asiatimes.com/2020/12/hamas-aims-precision-cruise-missiles-at-israel/

A Hamas member stands next to a missile on World Quds Day in May 2020. Photo: Twitter

A war of words broke out in Israel's Knesset (Parliament) between Avigdor Lieberman, who heads the Yisrael Beiteinu ("Israel Our Home") party and MK Member Shlomo Karai, from the leading Likud ("Unity") party. At issue was the alleged leak of security information on new weapons in the hands of Hamas, the militant Islamic Palestinian nationalist movement that has run the Gaza strip since 2007. Lieberman himself is a former Minister of Defense, Minister of Foreign Affairs, Infrastructure Minister and Deputy Prime Minister.

Lieberman claimed that Prime Minister Benjamin Netanyahu and Defense Minister (and deputy prime minister) Benny Gantz were covering up information about precision cruise missiles and cluster bombs being produced by Hamas.

Hamas has a considerable arsenal of rockets including the Khaibar-1 M-302 which is smuggled to Gaza and originates in Syria. Based on the Chinese WS-1 or WS-1B multiple launch rocket system, it has a range of around 200 km (125 miles). Israel has also been hit by 122mm Chinese-made rockets fired by Hamas and by the Iranian-made Fajr-5 MLRS rocket, a 333mm long range weapon.

Most of the rocket attacks launched by Hamas have been Qassams in different versions (Qassam 1, 2, 3). These are short range rockets with a range of about 10 km (6.2 miles) and a small, but lethal warhead between 10 and 20 kg (22 to 44 lbs). More than 2,000 of these have been shot down by Israel's Iron Dome system.

None of these rockets are precision enough to accurately target Israel's critical infrastructure.

Hamas was not known to have cruise missiles and certainly no precision cruise missiles. Since Saudi Arabia's oil fields were hit by Iranian Quds cruise missiles, there has been growing concern in Israel, Saudi Arabia and elsewhere that for the first time critical infrastructure targets could be knocked out by precision weapons such as those that crashed into four Saudi oil storage tanks launched hundreds of miles away.

There are a number of reports that the Iranian cruise missiles that hit their targets in Saudi Arabia were Quds-1 or Quds-2 cruise missiles modified to be able to fly autonomously to their target and hit with high precision. In 2019 at the MAKS airshow Iran unveiled a new cruise missile called Mobeen that, Iran claimed, was fitted out with a digitized scene-mapping area correlator (DSMAC) and a terrain contour matching (TERCOM) system for navigation. There are unconfirmed reports that some of the crashed Quds cruise missiles found in Saudi Arabia included a TERCOM system. Iran claims Mobeen has been in service since 2018.

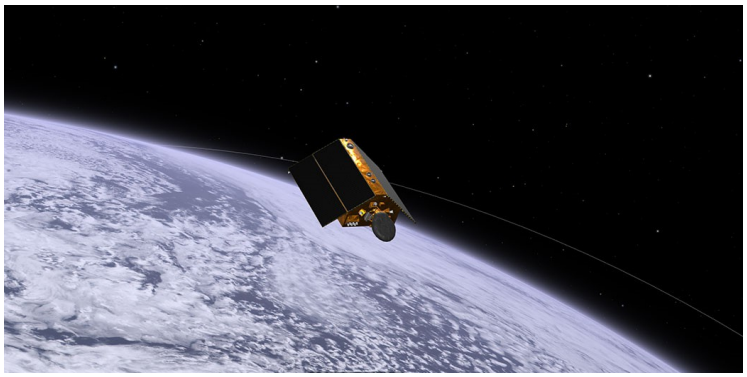
The US Tomahawk Cruise missile system used a digitized scene mapping system and TERCOM. For the Tomahawk to work effectively the targeted area has to be carefully photographed so that the target "scene" can be stored in the Tomahawk's computer memory. When the Tomahawk observes the real scene and can match it, it strikes the target.

The Tomahawk dates back to 1983. The original version has been augmented by military GPS and by satellite support for highly precise scene matching.

(Continued on Page 26)

Follow Sentinel-6 Michael Freilich in Real Time As It Orbits Earth

https://www.nasa.gov/feature/jpl/follow-sentinel-6-michael-freilich-in-real-time-as-it-orbits-earth (25 November, 2020)



The Sentinel-6 Michael Freilich satellite launched from Vandenberg Air Force Base in central California on Nov. 21. NASA's Eyes visualization tools lets you track the spacecraft as begins its mission to measure sea level height as it orbits Earth.
Credits: NASA/JPL-Caltech

With NASA's Eyes on the Earth web-based app, you can tag along with the U.S.-European satellite as it orbits the globe, gathering critical measurements of our changing planet.

When Sentinel-6 Michael Freilich was encapsulated in the payload fairing of a SpaceX Falcon 9 rocket, it was the last time human eyes would have a close-up look at the satellite. But now that the spacecraft is in orbit after launching from Vandenberg Air Force Base in central California on Nov. 21, NASA's Eyes on the Earth is keeping track.

The app provides a 3D visualization of the sea-level-monitoring satellite, letting you see where it is right now as it glides over the cloud-covered globe.

Rendered in stunning detail, the spacecraft's avatar even includes the instruments it will use to measure sea level height and gather atmospheric data. With the click of a mouse, you can rotate the satellite to see it from any angle, watch it fly above Earth in real-time, or speed it up to see its entire five-and-a-half-year mission unfold over a few minutes.

"What we create for Eyes is an engineering model of the real thing. You can get lost in the detail – not just in how the sunlight reflects off the spacecraft's solar panels but how you can track its exact location in orbit," said Jason Craig, visualization producer at NASA's Jet Propulsion Laboratory in Southern California. "We have data streaming from space missions near and far, and we've put that data to work. Sentinel-6 Michael Freilich is only the latest spacecraft to be added to the growing number of missions."

As a bonus, the Sentinel-6 Michael Freilich satellite model has also been added to the Webby award-winning Eyes on the Solar System. The web-based application has customizable pop-up menus that allow you to zoom in and out to see where Sentinel-6 Michael Freilich is in comparison with other Earth-observing satellites. You can even put it side-by-side with other spacecraft orbiting other planets.

Find out more about Sentinel-6 Michael Freilich as it orbits Earth to collect critical sea level and atmospheric data. Click anywhere on the image to take it for a spin. View the full interactive experience at Eyes on the Solar System. Credit: NASA/JPL-Caltech

While you're exploring, zoom through the rest of the solar system and travel to distant worlds with Eyes on ExoPlanets.

More About the Mission

Sentinel-6 Michael Freilich will be followed by its twin Sentinel-6B in 2025. Together, they make up the Sentinel-6/Jason-CS mission, which was developed by ESA (European Space Agency) in the context of the European Copernicus program led by the European Commission, the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), NASA, and the National Oceanic and Atmospheric Administration (NOAA), with funding support from the European Commission and technical support from France's National Centre for Space Studies (CNES).

JPL, a division of Caltech in Pasadena, built three science instruments for each Sentinel-6 satellite: the Advanced Microwave Radiometer, the Global Navigation Satellite System - Radio Occultation, and the Laser Retroreflector Array. NASA also contributed launch services, ground systems supporting operation of the NASA science instruments, the science data processors for two of these instruments, and support for the international Ocean Surface Topography Science Team. The launch was managed by NASA's Launch Services Program, based at the agency's Kennedy Space Center in Florida.

To learn more about Sentinel-6 Michael Freilich, visit:
https://www.nasa.gov/sentinel-6
https://www.esa.int/Sentinel-6
https://edefis.eu/CopernicusFactsheets

NASA Lines Up Artemis I Rocket Booster Motors for Stacking *(25 Nov., 2020)*

https://www.nasa.gov/exploration/systems/sls/multimedia/artemis-I-rocket-booster-motors-lined-up-for-stacking.html

Image Credit: NASA

Eight rocket motor segments for the first flight of NASA's Space Launch System (SLS) are lined up in preparation for stacking at NASA's Kennedy Space Center in Florida. As each segment completed processing, workers moved them to the surge bay at Kennedy's Rotation, Processing, and Surge Facility. Each of the fully assembled, 177-foot-tall solid rocket boosters on SLS produce more than 3.6 million pounds of thrust and together provide more than 75% of the total thrust during the first two minutes of launch and flight. The booster segments will help power the first Artemis mission of NASA's Artemis program with the SLS rocket. NASA's Exploration Ground Systems team transported the motor segments to the Vehicle Assembly Building (VAB), and will use a crane to lift the booster segments and stack them one by one on the mobile launcher. The bottom section of the boosters, known as the aft assemblies, were completed in November and moved to the VAB, and the first of the two pieces was placed on the mobile launcher Nov. 21. The boosters are the first elements of SLS to be installed on the mobile launcher ahead of the Artemis I launch. After booster stacking is complete, the core stage, which is undergoing final Green Run testing at NASA's Stennis Space Center near Bay St. Louis, Mississippi, will be delivered to Kennedy and moved to the VAB to continue rocket construction.

NASA is working to land the first woman and the next man on the Moon by 2024. SLS and Orion, along with the human landing system and the Gateway in orbit around the Moon, are NASA's backbone for deep space exploration. SLS is the only rocket that can send Orion, astronauts, and supplies to the Moon in a single mission.

BepiColombo (ESA-JAXA Spacecraft)

https://solarsystem.nasa.gov/missions/bepicolombo/in-depth/

An artist's impression of the ESA-JAXA BepiColombo spacecraft. Credit: ESA/ATG medialab

What is BepiColombo?

BepiColombo is an international mission comprised of two spacecraft riding together to Mercury to orbit and to study the planet from unique vantage points. The European Space Agency (ESA) provided one orbiter. The Japan Aerospace Exploration Agency (JAXA) supplied the second orbiter.

•BepiColombo launched in October 2018 and is scheduled to begin orbiting Mercury in 2025.

•ESA's Mercury Planetary Orbiter (MPO) will study the planet's surface and interior.

•JAXA's Mercury Magnetospheric Orbiter (MMO) will study the planet's magnetic field.

•These are the first Mercury missions for the ESA and Japan. Only two other spacecraft have visited Mercury: NASA's Mariner 10 and MESSENGER.

Nation	Europe and Japan
Objective(s)	Mercury Orbit
Spacecraft	BepiColombo
Spacecraft Mass	9,040 pounds (4,100 kilograms)
Mission Design and Management	ESA and JAXA
Launch Vehicle	Ariane 5
Launch Date and Time	Oct. 20, 2018 | 01:45:28 UT
Launch Site	Guiana Space Centre, Kourou, French Guiana
Scientific Instruments	**Mercury Planetary Orbiter (MPO):** 2,540 pounds (1,150 kilograms) 1. BELA–BepiColombo Laser Altimeter 2. ISA–Italian Spring Accelerometer 3. MPO-MAG–Magnetic Field Investigation 4. MERTIS–Mercury Radiometer and Thermal Imaging Spectrometer 5. MGNS–Mercury Gamma-Ray and Neutron Spectrometer 6. MIXS–Mercury Imaging X-ray Spectrometer 7. MORE–Mercury Orbiter Radio Science Experiment 8. PHEBUS–Probing of Hermean Exosphere by Ultraviolet Spectroscopy 9. SERENA–Search for Exosphere Refilling and Emitted Neutral Abundances (neutral and ionized particle analyzer) 10. SIMBIO-SYS–Spectrometers and Imagers for MPO BepiColombo Integrated Observatory 11. SIXS–Solar Intensity X-ray and Particle Spectrometer **Mercury Magnetospheric Orbiter (MMO):** 606 pounds (275 kilograms): 1. MMO-MGF–Mercury Magnetometer 2. MPPE–Mercury Plasma Particle Experiment 3. PWI–Mercury Plasma Wave Instrument 4. MSASI–Mercury Sodium Atmospheric Spectral Imager 5. MDM–Mercury Dust Monitor

Key Dates

Oct. 20, 2018 | 01:45:28 UT: Launch

April 13, 2020: Earth flyby

Oct. 16, 2020: Venus flyby

Aug. 11, 2020: Venus Flyby

Oct. 2, 2021: Mercury flyby

June 23, 2022: Mercury flyby

June 20, 2023: Mercury flyby

Sept. 5, 2024: Mercury flyby

Dec. 2, 2024: Mercury flyby

Jan. 9, 2025: Mercury flyby

Dec. 5, 2025: Mercury orbital insertion

(Continued on Page 27)

AIAA Mentor Match on Engage *(Screenshots only)*

https://engage.aiaa.org/mentor-match

From Dr. Dan Dumbcher, AIAA Executive Director: "I encourage all our members to participate in our new **Mentor Match program**, as either a mentor or mentee. The program gives young professionals the opportunity to get one-on-one guidance from an established AIAA member as they advance in their careers. Fostering these relationships and learning opportunities are critical to our future success. I have already connected with two students myself and am looking forward to a many more!"

(Editor's note: All AIAA members automatically have the Engage account, using the same login as the aiaa.org online account.)

AIAA LA-LV Online Gallery *(Screenshots only)*

https://aiaa-lalv.org/gallery/

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https://aiaa-lalv.org/gallery/

Gallery-Art

Ms. Veronica Brooks

Mr. Vahik Khodagolian

https://aiaa-lalv.org/gallery/gallery-art/

Israel's multilayer air defense system a new age missile-killer

Israel's Iron Dome and David's Sling air defenses prove effective against state-of-the-art cruise missile threats

by Dr. Stephen Bryen, Former Deputy Under Secretary of Defense (with Permission), 16 December, 2020

https://asiatimes.com/2020/12/israels-multilayer-air-defense-system-a-new-age-missile-killer/

US army soldiers look at anti-missile system David's Sling during joint Israeli-US military training at the Hatzor Airforce Base in Israel on March 8, 2018. Photo: AFP/Jack Guez

Israel has carried out a test of its air defenses, which for the first time reveals a highly integrated system that can knock out a broad spectrum of targets, from maneuvering ballistic missiles to simple drones.

This accomplishment has far-reaching implications, not only for Israel's defense capabilities but for the United States. The US Army is in the process of developing an integrated tactical defense system called the Integrated Air and Missile Defense Battle Command System.

If the Israeli air defense integration is complete, it is probably the first time that systems optimized for different threats can share threat data and hand off responsibility to different "tiers" of the defense system.

Unlike the US effort, Israel's integrated system is national and includes ballistic missile defenses (BMD). The US Army system is tactical and only attempts to deal with tactical ballistic missile threats – and even there relies on the evolved but still antiquated Patriot system.

Above all, the Israeli test for the first time demonstrated a system that can destroy cruise missiles.

While most of the global focus since the Nagorno-Karabakh conflict has been on drones as an emerging unconventional threat to traditional military operations, the cruise missile presents the biggest threat to critical infrastructure installations and defense bases, both forward operating and fixed bases at the national level.

The rise of high precision cruise missiles in the hands of second-tier actors such as Iran – and Iran's client Yemen – presents a threat to Israel and to its new-found allies and friends in the Gulf states.

The unacknowledged Iranian attacks on two Saudi Arabian facilities, Abqaiq and Khurais, made clear that Iran had the ability to fire autonomous drones and cruise missiles and strike targets at high accuracy without a "man in the loop."

Military vehicles carrying YJ-18 anti-ship and land-attack cruise missiles drive past Tiananmen Square during the military parade to celebrate the 70th anniversary of the founding of the People's Republic of China. Photo: AFP/Anna Ratkoglo/Sputnik

Cruise missiles on long flights use highly accurate gyroscopes for navigation, augmented by GPS and supported by scene matching cameras and software. Typically gyroscopes are mechanical and electrical, require spin-up time and need to be updated.

In the past 20 years, ring laser gyros have become available, first in the United States. These gyros are far more accurate than mechanical ones. China, for example, is producing ring laser gyros (RLG), fiber optic gyros and microfabricated MEMS gyros.

These gyros are expensive and range in price from US$2,000 to $100,000 each. But even electro-mechanical gyros accuracy can be updated by GPS, which seems to be what the Iranians did in their attacks on the Saudi oil installations.

The gyros found there on both drones and cruise missiles were types V-9 and V-10 respectively, either imported to Iran from China or possibly, but less likely, locally manufactured in Iran.

(Continued on Page 29)

AIAA LA-LV e-Town Hall Meeting (21 November, 2020) *(Screenshots Only)*

Part I: Interstellar Flight Environments and Effects by Dr. Henry B. Garrett

Part II: Boeing EA-18G Growler by Mr. Lynn Jenson

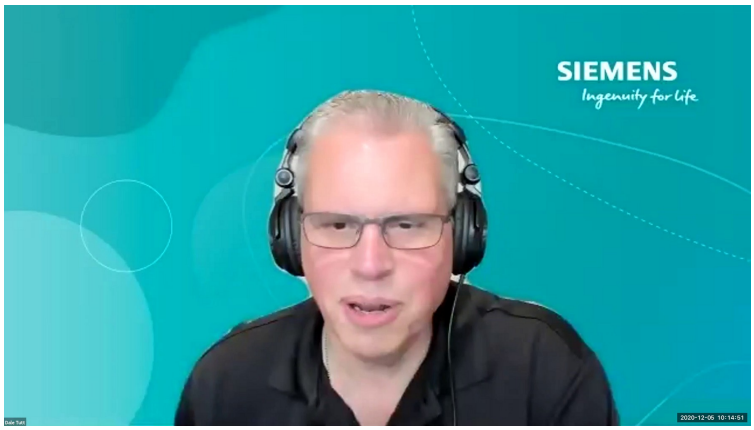
https://aiaa-lalv.org/november-21-2020-e-town-hall-meeting-with-dr-henry-b-garrett-and-mr-lynn-jenson/

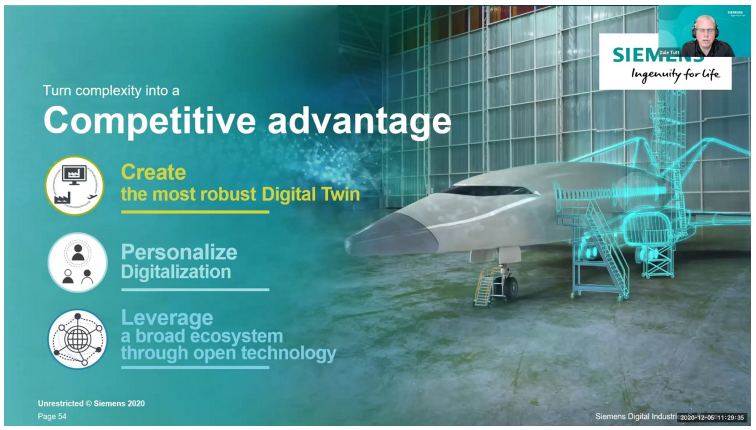
Dr. Henry B. Garrett presenting the exciting interstellar radiation environments and the possible safer ways for conducting interstellar missions, robotic or human.

Mr. Lynn Jenson presenting the inspiring aircraft of the Boeing EA-18G, the Growler, with its interesting history and fun stories.

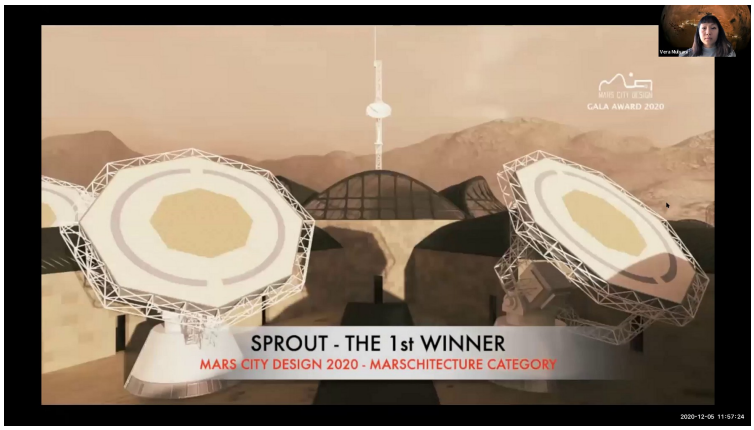
AIAA LA-LV e-Town Hall Meeting (5 December, 2020) *(Screenshots Only)*

Part I: Digitalization - the Crucial Advantage for the Modern Aerospace Program by Mr. Dale Tutt
Part II: Does art really have its place in the space mission design? Mars City Urban Farming Design Winners 2020 by Ms. Vera Mulyani
Part III: Protecting Planet Earth from NEO-NEA, by Ms. Mariella Graziano, Ms. Nancy C. Wolfson and Ms. Smiriti Srivastava
https://aiaa-lalv.org/december-5-2020-aerospace-digitalization-mars-city-design-contest-neo-planetary-defense



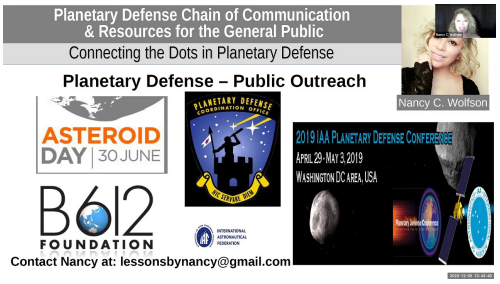


Mr. Dale Tutt introducing the Digital Twin and the importance of digitalization in Aerospace & Defense, using inspiring examples.

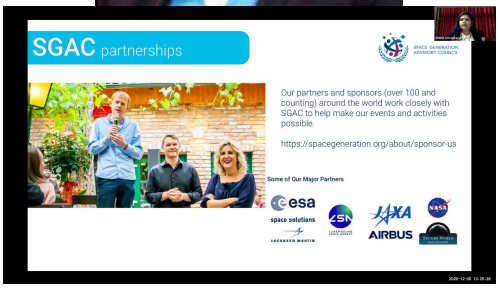


Ms. Vera Mulyani sharing her ideas of applying art in space missions, showing the winning designs for the future human city on Mars.

Ms. Mariella Graziano



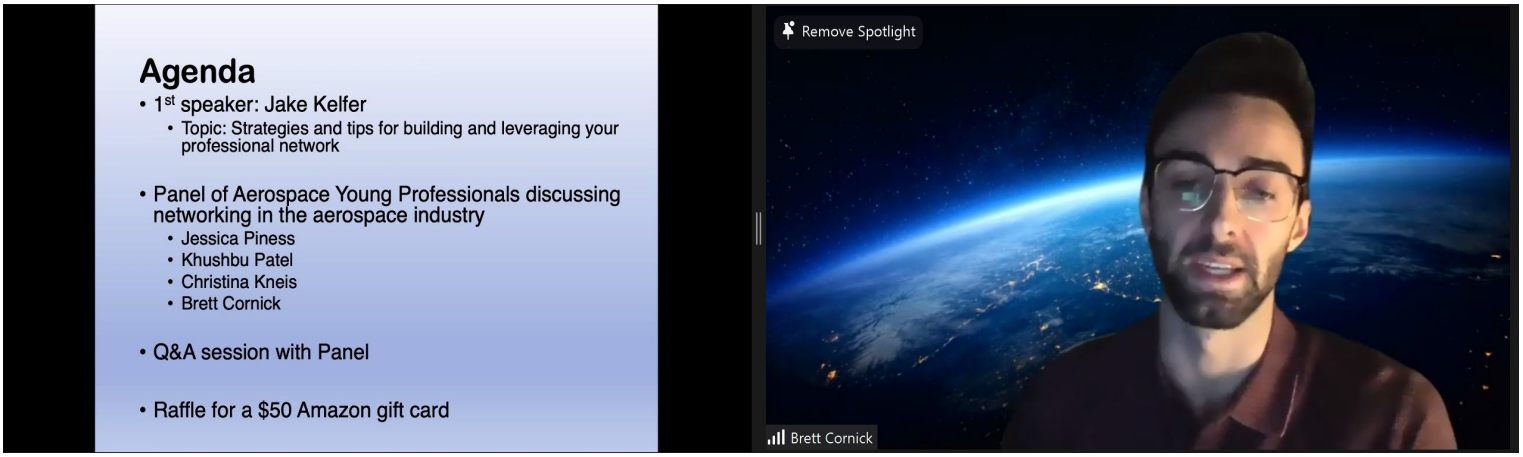
Ms. Nancy C. Wolfson



Ms. Smiriti Srivastava

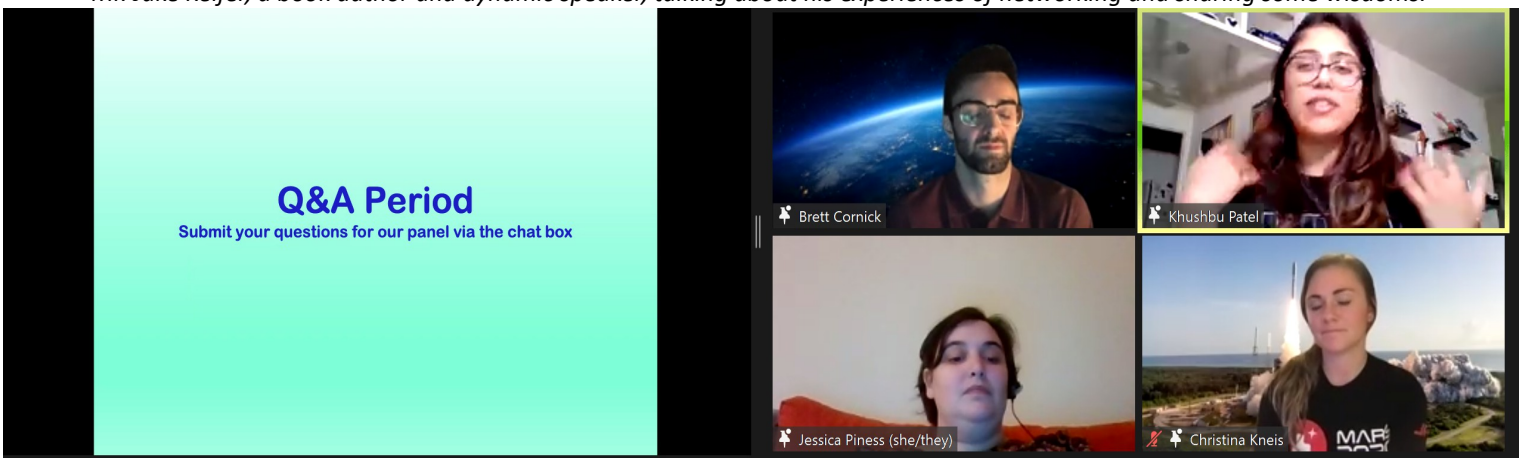
AIAA LA-LV Young Professional (YP) Meeting (10 December, 2020) *(Screenshots Only)*

How to Start an Aerospace Business with Limited Resources Part III: Leveraging Your Network for Success *https://aiaa-lalv.org/december-10-2020-young-professional-meeting-leveraging-your-network-for-success/*



Mr. Brett Cornick starting the meeting with introduction & the agenda for this Young Professional meeting to learn how to start a business.

Mr. Jake Kelfer, a book author and dynamic speaker, talking about his experiences of networking and sharing some wisdoms.



Mr. Brett Cornick moderating and leading the panel discussion and Q&A session with panelists Ms. Khushbu Patel, Ms. Jessica Piness, and Ms. Christina Kneis, having a fantastic and informative session for helping the young professionals who would like to start their own business.

AIAA LA-LV Aero Alumni December Meeting (16 December, 2020) *(Screenshots Only)*

China's Chang'e-5 mission returns Moon samples (17 December, 2020) *https://www.bbc.com/news/science-environment-55323176*
Jupiter and Saturn Conjunction in December, 2020: *https://www.skyatnightmagazine.com/advice/skills/great-conjunction-jupiter-saturn/*

Gary led the discussion on the Chinese Chang'e 5 Lunar Sample Return capsule landing in Inner Mongolia, China just a few hours ago.

Jerry showed the Saturn/Jupiter Conjunction diagram in his virtual background, with closest on Dec. 21. Please see the URL link above.

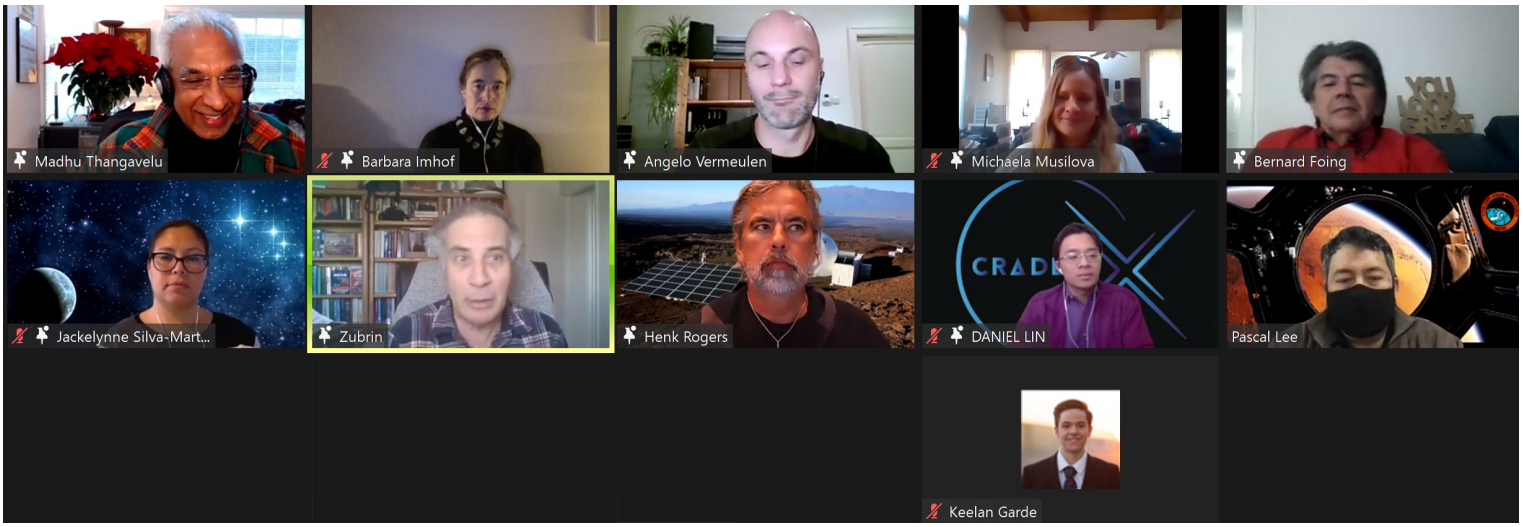
Attendees happily sharing life stories, concerns about technology espionage, national security, northeastern winter storm, Jupiter/Saturn Conjunction, astronomy, SR-71 during the Middle East Conflict in the '70s & '80s, Lunar missions, etc.

AIAA LA-LV Space Architecture Gathering & Christmas Party (19 December, 2020)

(Screenshots Only)

Part I: Simulators and Simulations, Part II: Space Architecture

https://aiaa-lalv.org/december-19-2020-aiaa-la-lv-space-architecture-gathering/



Panel Discussion for the Morning session on Simulators and Simulations

Panel Discussion for the Afternoon session on Space Architecture

Morning - Simulators and Simulations

(All Time PST (Pacific Standard Time)
10:05 am: Dr. Chandrashekar Sonwane (Welcome)
10:10 am: Prof. Madhu Thangavelu USC (Introduction – Part 1)
10:20 am: Prof. Bernard Foing – Advanced Projects, European Space Agency
10:35 am: Mr. Keelan Garde & Mr. Daniel Lin – CRADLE Simulator, Lucerne Valley
10:50 am: Ms.Jackelynne Silva-Martinez - Gateway Human Systems Integration Lead, NASA JSC
11:05 am: Dr. Pascal Lee – SETI, Director of the NASA Haughton-Mars Project at NASA ARC, Chairman Mars Institute
11:20 am: Mr. Henk Rogers – Chairman PISCES, Founder International MoonBase Alliance
11:35 am: Dr. Angelo Vermeulen - SEADS Network, Delft University
11:50 am: Dr. Bob Zubrin – Mars Society, Mars Desert Research Station
12:05 pm: Dr. Barbara Imhof – Liquifer, Vienna
12:20 pm: Prof. Garrett Reisman, Astronaut, Q&A with Prof. Madhu Thangavelu
12:35 pm: Dr. Michaela Musilova, Director HI-SEAS Project, Hawaii
12:50 pm: Panel Discussion
01:15 pm: Fin - Part 1

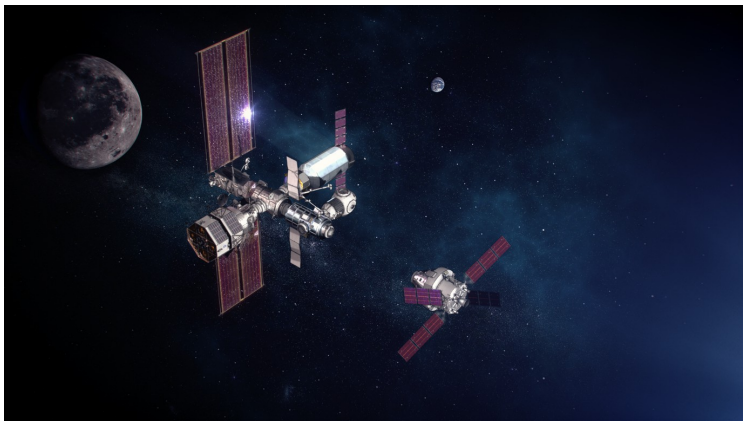
Afternoon– International Space Architects

01:20 pm: Prof. Madhu Thangavelu (Introduction Part 2)
01:30 pm: Prof. Samer El-Sayary – Alexandra University Egypt
01:45 pm: Mr. Anthony Longman – SkyFrame Research
02:00 pm: Prof. Valentina Sumini- MIT MediaLab, Milan Polytechnic University(PoliMi)
02:15 pm: Ms. Vera Mulyani – Founder & CEO, Mars City Design
02:30 pm: Dr. Tom Spilker & Mr. John Blincow – Gateway Foundation
02:45 pm: Mr. Tomas Rousek – XTEND DESIGN Architects, London
03:00 pm: Mr. Thomas Schmidt – Sepia Design Consultants Ltd., Hong Kong
03:15 pm: Ms. Meeradevi Kathaliyil – HOK, Dubai
03:30 pm: Ms. Tamara Stefanovic & Ms. Sara Kocevska, Polytechnic University of Milan
03:45 pm: Ms. Ziyu (Ivy) Jiang, PG20 Bartlett, University College London
04:00 pm: Mr. Theodoros Tamvakis, PG20 Bartlett, University College London
04:15 pm: Mr. Will Hosikian - Woods Bagot Architecture, RMIT
04:30 pm: Mr. Sam Ximenes, President, XArc Exploration Architecture Corporation and Astroport Space Technologies, Inc.
04:45 pm: Panel Discussion
05:30 pm: Fin - Part 2

Agenda for 19 December. 2020 AIAA Space Architecture Gathering (Part 1 and Part 2)

NASA, Canadian Space Agency Formalize Gateway Partnership for Artemis Program

https://www.nasa.gov/press-release/nasa-canadian-space-agency-formalize-gateway-partnership-for-artemis-program (16 Dec., 2020)



NASA and the Canadian Space Agency (CSA) finalized an agreement between the United States and Canada to collaborate on the Gateway, an outpost orbiting the Moon that will provide vital support for a sustainable, long-term return of astronauts to the lunar surface as part of NASA's Artemis program. This Gateway agreement further solidifies the broad effort by the United States to engage international partners in sustainable lunar exploration as part of the Artemis program and to demonstrate technologies needed for human missions to Mars.

Under this agreement, CSA will provide the Gateway's external robotics system, including a next-generation robotic arm, known as Canadarm3. CSA also will provide robotic interfaces for Gateway modules, which will enable payload installation including that of the first two scientific instruments aboard the Gateway. The agreement also marks NASA's commitment to provide two crew opportunities for Canadian astronauts on Artemis missions, one to the Gateway and one on Artemis II.

"Canada was the first international partner to commit to advancing the Gateway in early 2019, they signed the Artemis Accords in October, and now we're excited to formalize this partnership for lunar exploration," said NASA Administrator Jim Bridenstine. "This agreement represents an evolution of our cooperation with CSA providing the next generation of robotics that have supported decades of missions in space on the space shuttle and International Space Station, and now, for Artemis."

CSA will be responsible for end-to-end external robotics, including engineering and operations. Canadarm3 will move end-over-end to reach many parts of the Gateway's exterior, where its anchoring "hand" will plug into specially designed interfaces. Delivery to the lunar outpost is targeted in 2026 via a U.S. commercial logistics supply flight.

"Gateway will enable a robust, sustainable, and eventually permanent human presence on the lunar surface where we can prove out many of the skills, operations, and technologies that will be key for future human Mars missions," said Kathy Lueders, NASA's associate administrator for human exploration and operations.

Approximately one-sixth the size of the International Space Station, the Gateway will function as a way station located tens of thousands of miles at its farthest distance from the lunar surface, in a near-rectilinear halo orbit. From this lunar vantage, NASA and its international and commercial partners will conduct unprecedented deep space science and technology investigations. It will serve as a rendezvous point for astronauts traveling to lunar orbit aboard NASA's Orion spacecraft and Space Launch System rocket prior to transit to low-lunar orbit and the surface of the Moon.

"CSA's advanced robotics contribution with Canadarm3 builds upon our long spaceflight history together, enabling us to perform critical long-term sustainability and maintainability functions, overall inspections of the external Gateway and its attached vehicles, and servicing of external payloads in support of our worldwide research initiatives," said Dan Hartman, Gateway program manager at NASA's Johnson Space Center in Houston. "Our efforts are well underway on Gateway to integrate CSA's robotics system with arm attachment points and smaller dexterous adaptors already being incorporated into the individual Gateway modules including the PPE (power and propulsion element), HALO (habitation and logistics outpost), Gateway logistics, and international habitation element designs."

NASA astronauts will board a commercially developed lander for the final leg of the journey to the lunar surface, and the agency has contracted with U.S. industry to develop the first two Gateway components, PPE and HALO, as well as logistics resupply for Gateway.

(Continued on Page 31)

Daylight Fireball over Central New York - *More than 150 reports from 7 states*

by American Meteor Society (AMS) (with Permission), 3 December, 2020

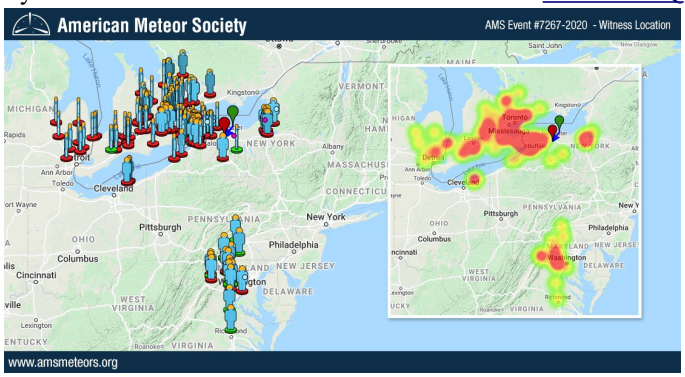
https://amsmeteors.org/2020/12/daylight-fireball-over-central-new-york/

The AMS received more than 150 reports so far about a daylight fireball event that occurred over New York on December 2nd, 2020 around 12:08pm EST (17:08 Universal Time). The AMS #2020-7267 event was mainly seen from the New York and Ontario but we also received reports from Maryland, Michigan, Ohio, Pennsylvania and Virginia.

If you witnessed this event and/or if you have a video or a photo of this event, please

Submit an Official Fireball Report

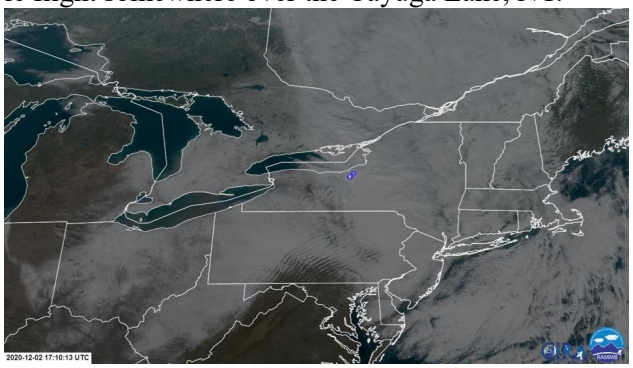
If you want to learn more about Fireballs: read our Fireball FAQ.



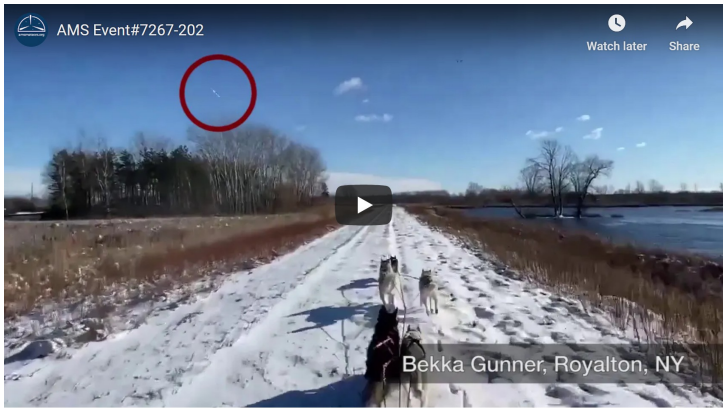
Loud Boom, trajectory and videos

Dozen of people contacted local media area about a loud boom heard at the time of the event in central New York. When a very bright fireball penetrates to the stratosphere, below an altitude of about 30 miles (50 km), and explodes as a bolide, there is a chance that sonic booms may be heard on the ground below. NASA analysis of the event shown that the parent meteoroid at the origin of the event entered Earth's atmosphere over upper New York, between Rochester and Syracuse. Traveling westward at 56,000 miles per hour (90,000 km/h), it broke into pieces at an altitude of approximately 22 miles (35 km), producing a bright flash reported by the public and caught in videos.

The bolide was detected by the Geostationary Lightning Mapper onboard the GOES 16 weather satellite. The ground track of the event computed by NASA shows that the fireball was travelling from North East to South West and ended its visible flight somewhere over the Cayuga Lake, NY.



Sed Dog enthousiast Bekka Gunner was lucky enough to catch the event on camera while dog sledding in Royalton, near the Erie, Genesee border:

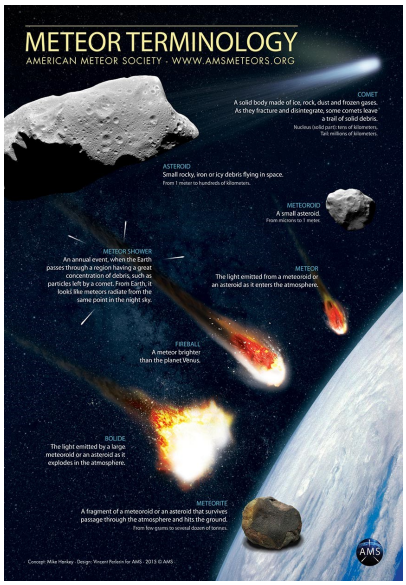


https://youtu.be/a6Xv3dqRci4

Fireball, Bolide?

Several thousand meteors of fireball magnitude occur in the Earth's atmosphere each day. The vast majority of these, however, occur over the oceans and uninhabited regions, and a good many are masked by daylight. Those that occur at night also stand little chance of being detected due to the relatively low numbers of persons out to notice them.

Additionally, the brighter the fireball, the more rare is the event. As a general thumb rule, there are only about 1/3 as many fireballs present for each successively brighter magnitude class, following an exponential decrease. Experienced observers can expect to see only about 1 fireball of magnitude -6 or better for every 200 hours of meteor observing, while a fireball of magnitude -4 can be expected about once every 20 hours or so.

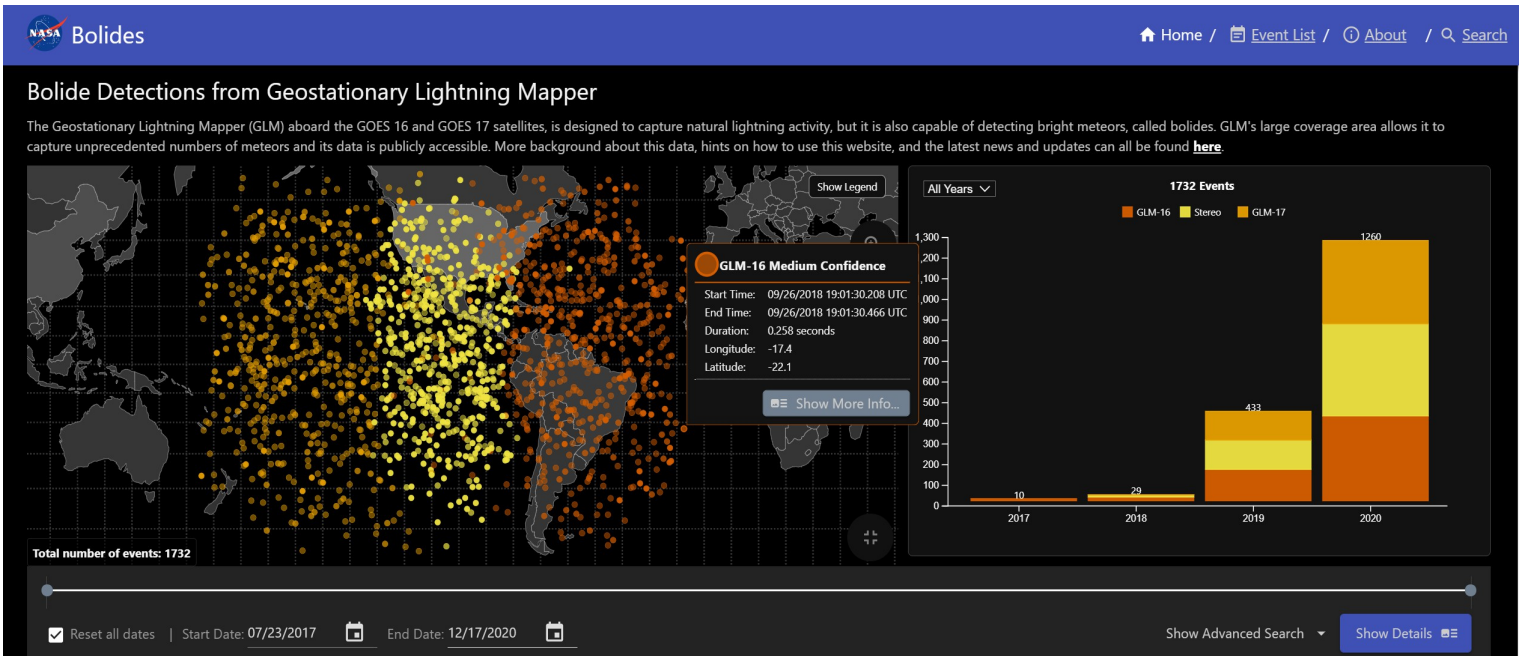


https://www.amsmeteors.org/resources/posters/

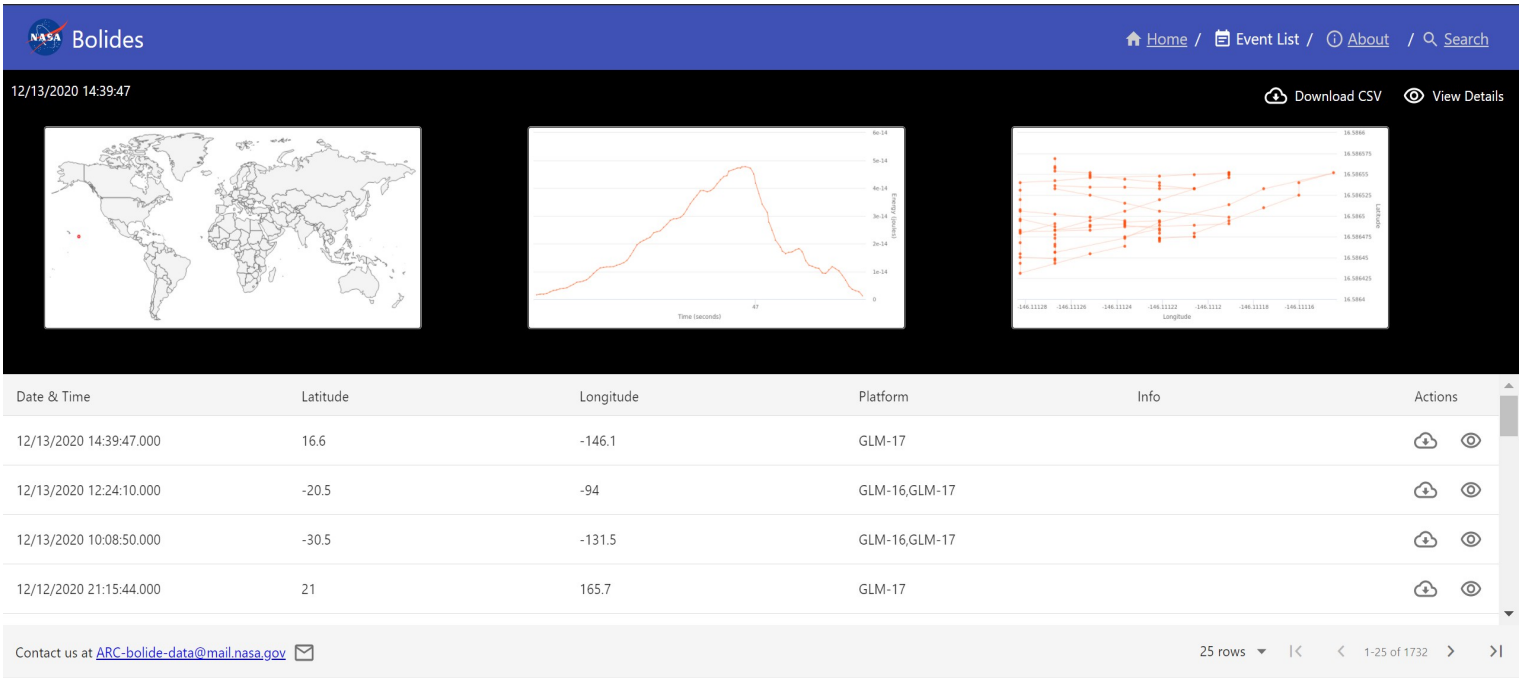
Bolide Detections from Geostationary Lightning Mapper

https://neo-bolide.ndc.nasa.gov/ *(Recommended by Dr. Nahum Melamed, The Aerospace Corporation)*

The Geostationary Lightning Mapper (GLM) aboard the GOES 16 and GOES 17 satellites, is designed to capture natural lightning activity, but it is also capable of detecting bright meteors, called bolides. GLM's large coverage area allows it to capture unprecedented numbers of meteors and its data is publicly accessible. More background about this data, hints on how to use this website, and the latest news and updates can all be found here.

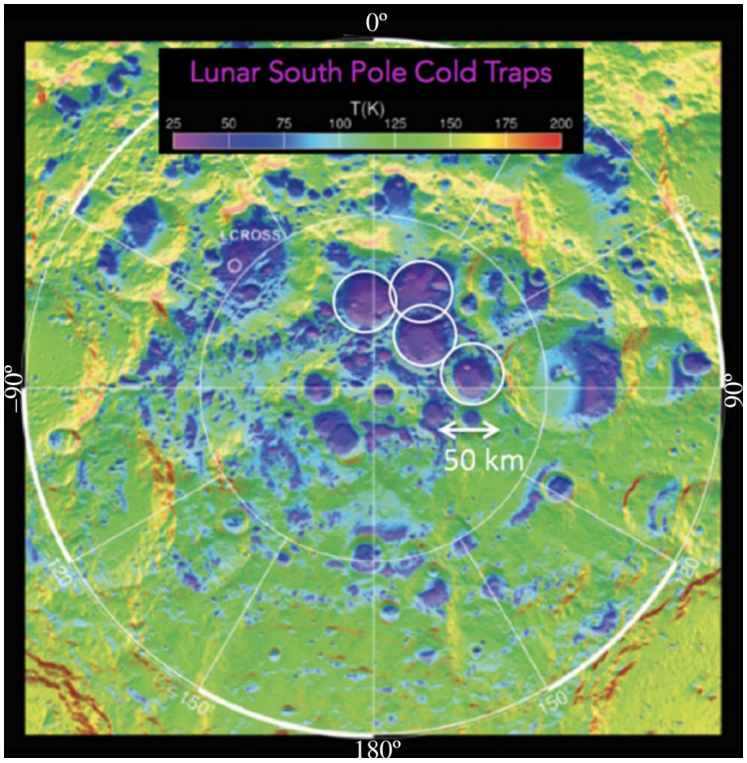


https://neo-bolide.ndc.nasa.gov/



https://neo-bolide.ndc.nasa.gov/#/search

Growing Interest in Moon Resources Could Cause Tension, Scientists Find (Continued from Page 1)



Lunar cold traps located at the South Pole of the moon, are critical to all moon-based operations because they contain frozen water molecules. Water is required for all moon-based operations because it is needed to grow food, and to break down into oxygen for breathing and hydrogen for fuel. The four white-circled regions in this image contain the coldest terrain with average annual near-surface temperatures of 25-50 K. They are about 50 km across. Credit: David Paige, reproduced with permission.

Resources like water and iron are important because they will enable future research to be conducted on, and launched from, the moon. "You don't want to bring resources for mission support from Earth, you'd much rather get them from the Moon. Iron is important if you want to build anything on the moon; it would be absurdly expensive to transport iron to the moon," said Elvis. "You need water to survive; you need it to grow food—you don't bring your salad with you from Earth—and to split into oxygen to breathe and hydrogen for fuel."

Interest in the moon as a location for extracting resources isn't new. An extensive body of research dating back to the Apollo program has explored the availability of resources such as helium, water, and iron, with more recent research focusing on continuous access to solar power, cold traps and frozen water deposits, and even volatiles that may exist in shaded areas on the surface of the moon. Tony Milligan, a Senior Researcher with the Cosmological Visionaries project at King's College London, and a co-author on the paper said, "Since lunar rock samples returned by the Apollo program indicated the presence of Helium-3, the moon has been one of several strategic resources which have been targeted."

Although some treaties do exist, like the 1967 Outer Space Treaty—prohibiting national appropriation—and the 2020 Artemis Accords—reaffirming the duty to coordinate and notify—neither is meant for robust protection. Much of the discussion surrounding the moon, and including current and potential policy for governing missions to the satellite, have centered on scientific versus commercial activity, and who should be allowed to tap into the resources locked away in, and on, the moon. According to Milligan, it's a very 20th century debate, and doesn't tackle the actual problem. "The biggest problem is that everyone is targeting the same sites and resources: states, private companies, everyone. But they are limited sites and resources. We don't have a second moon to move on to. This is all we have to work with." Alanna Krolikowski, assistant professor of science and technology policy at Missouri University of Science and Technology (Missouri S&T) and a co-author on the paper, added that a framework for success already exists and, paired with good old-fashioned business sense, may set policy on the right path. "While a comprehensive international legal regime to manage space resources remains a distant prospect, important conceptual foundations already exist and we can start implementing, or at least deliberating, concrete, local measures to address anticipated problems at specific sites today," said Krolikowski. "The likely first step will be convening a community of prospective users, made up of those who will be active at a given site within the next decade or so. Their first order of business should be identifying worst-case outcomes, the most pernicious forms of crowding and interference, that they seek to avoid at each site. Loss aversion tends to motivate actors."

(Continued on the next page)

Growing Interest in Moon Resources Could Cause Tension, Scientists Find *(Continued from the previous page)*

There is still a risk that resource locations will turn out to be more scant than currently believed, and scientists want to go back and get a clearer picture of resource availability before anyone starts digging, drilling, or collecting. "We need to go back and map resource hot spots in better resolution. Right now, we only have a few miles at best. If the resources are all contained in a smaller area, the problem will only get worse," said Elvis. "If we can map the smallest spaces, that will inform policymaking, allow for info-sharing and help everyone to play nice together so we can avoid conflict."

While more research on these lunar hot spots is needed to inform policy, the framework for possible solutions to potential crowding are already in view. "Examples of analogs on Earth point to mechanisms for managing these challenges. Common-pool resources on Earth, resources over which no single act can claim jurisdiction or ownership, offer insights to glean. Some of these are global in scale, like the high seas, while other are local like fish stocks or lakes to which several small communities share access," said Krolikowski, adding that one of the first challenges for policymakers will be to characterize the resources at stake at each individual site. "Are these resources, say, areas of real estate at the high-value Peaks of Eternal Light, where the sun shines almost continuously, or are they units of energy to be generated from solar panels installed there? At what level can they can realistically be exploited? How should the benefits from those activities be distributed? Developing agreement on those questions is a likely precondition to the successful coordination of activities at these uniquely attractive lunar sites."

About Center for Astrophysics | Harvard & Smithsonian

Headquartered in Cambridge, Mass., the Center for Astrophysics | Harvard & Smithsonian (CfA) is a collaboration between the Smithsonian Astrophysical Observatory and the Harvard College Observatory. CfA scientists, organized into six research divisions, study the origin, evolution and ultimate fate of the universe.

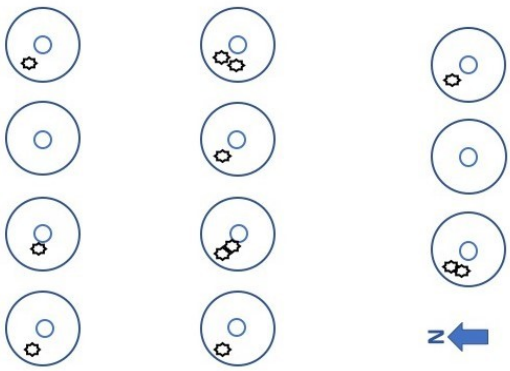
Has the UAV defined the modern battlespace? (Continued from Page 2)

As can be seen from the above images, Abqaiq from the north, east, southeast and south by air defenses. According to the UN Experts Team, it is now clear that the attacks came 27.00° N and 48.00° E, a waypoint location approximately 200 kilometers North-West of Abqaiq. (This has been established by exploiting the computer on a recovered drone that crashed before reaching its target. Its computer revealed the UAV was aimed at the Abqaiq facility.) From this it is clear that none of the Abqaiq or Khurais air defenses was able to detect either the drones or the cruise missiles used in the attack.

While the UAV strikes in the Nagorno Karabakh war were mostly single shot discrete events, the strikes in Saudi Arabia in September, 2019 were what amounts to swarming attacks. For example, at Abqaiq, nine separator tanks were hit, three of them twice. These strikes all occurred in a period estimated to be about 20 seconds.

Here is a photo in the UN Report of one of the separator tanks that was hit twice:

These attacks were surprisingly accurate. Below is the diagram provided by the UN Yemen Panel:



UN Diagram of Separator Tanks at Abqaiq

Each separator tank is 28 meters in diameter and 9 meters high.

The central question raised by the attacks in Saudi Arabia and in Nagorno Karabakh is why the air defense systems and radars did not detect the incoming drone threats. (In the Saudi case the radars also did not detect the cruise missiles.)

The Russians experienced similar problems in Syria in attacks on the Khmeimim Air Base. On multiple occasions the base was attacked by unmanned drones operating in swarms. The worst attack was in January, 2018 when ten drones rigged with explosive devices hit Russia's Khmeimim air base while three targeted the Russian Naval base in Tartus. Russia claims it shot down 7 of the drones using the Pantsir air defense system and was able to take control and land 6 others. Russia also said the airbase did not suffer any damage.

It is hard to say whether the Russian claims of success or their damage assessment is credible. The drones used in the attack were very low tech, made mainly of plywood and fabric with a small Chinese engine for power. Each drone carried ten rocket grenades that were released by a simple, solenoid controlled mechanism.

Was the Pantsir as successful as the Russian's claimed? What we do know is that a number of Pantsir air defense systems were destroyed by Turkish Bayraktar drones in Syria and in Lebanon. On one day alone in Libya, 9 Pantsir's were destroyed. The Bayraktar is a large drone. Its wingspan is 12 meters (39 feet), considerably larger than the wing span of an F-16 fighter jet at 9.96 meters (32 ft. 8 inches).

The Pantsir was "improved" after the 2018 attacks, or at least the Russian's said so. That's because it was clear that the Pantsir operated poorly when Khmeimim was attacked. As a result the Russian "success" claims should be dismissed.

Here is a photo from Khmeimim after the swarming drone attack in 2018. The aircraft looks like an Su-24:

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Has the UAV defined the modern battlespace? *(from the previous page)*

The main issue is if conventional radars of air defense systems can detect drones? Israel, which has specialized in going after quite small rockets fired principally by Hamas in Gaza, called Qassam does not escape Israel's Iron Dome system. But almost all these rockets have been hit while in flight (except those not targeted by Iron Dome), engines burning, and they fly only at relatively low altitudes in an arc trajectory. UAVs, contrariwise, do not have hot burning rocket engines –they are typically powered by small internal combustion engines run under battery power. And many UAVs are constructed of plastic or composites, some home built ones from woods such as balsam, so the only metal parts are the engines, which are typically quite small or not visible at all.

A good example is Bayraktar TB2 which is made of composites and Kevlar, not metal. It uses a small Austrian internal combustion engine which is inside the fuselage and in the rear where it drives a pusher prop, also made of composite. Although it is large, it hardly has an IR signature and its radar signature is quite small, perhaps too small for easy detection.

There are radars that can detect small drones, but most conventional air defense systems do not have them. Such new radars work differently than conventional radars –they have very high resolution scanning and they have computer algorithms that have signature data on different drone threats. When there is enough radar imagery to run through the computer data base, a drone sighting can be confirmed by the radar system and it can continue to track the object. The range is typically around one mile.

Looking beyond radars there are other ways to detect a drone. It is possible to detect transmissions from a drone and locate it that way (through triangulation). In some cases, a drone can be detected by sophisticated optical sensors. And if the drone makes enough noise it can be tracked acoustically. A modern drone detection system probably uses all these methods in combination and has elegant software to meld together all the information in near real time to reach a solution on its track and how to eliminate the drone as a threat.

There was only one such system active in Nagorno Karabakh that was brought in late in the war by the Russians. In Saudi Arabia there was no drone detection system as far as known. In Syria there were air defenses (since augmented by improved Pantsir and by S-400 at the Khmeimim base.) The Russians rushed in their Krasukha jamming system to counter the successful use of both armed drones such as the Bayraktar and suicide drones like the Israel-made loitering munition known as Harop by Azerbaijan. This would have been near the end of the war. So far as is known, the Krasukha jamming system was brought in to protect a Russian base near Yerevan. Even so, the Russians claims they knocked out 9 Bayraktar drones.

A question of Accuracy

While the Nagorno-Karabakh war showed accurate hits on targets, all the drones were controlled remotely, sometimes called "man in the loop" operators. It also appears to be the case that the attack and suicide drones were linked through command centers to surveillance drones. In practice this meant that surveillance drones could pick out and track lucrative targets and the information would be used to call in the nearest drone. This feature is seen in many of the videos that the Azeri defense ministry supplied online where the surveillance drone is viewing the target but where the rockets released by the drones arrives from a different angle and altitude. It is also clear in a video that tracks the destruction of two Smersh launchers. In that example the surveillance drone picks up the target, watches it launch rockets, follows it as it goes to a sheltered area and thereafter when an attack drone is available, the launchers are destroyed.

(Continued on the next page)

Has the UAV defined the modern battlespace? *(from the previous page)*

The Saudi situation was quite different. As the above diagram shows, the attacks were extremely accurate.

The question is, how come? The known communications range of the drones and cruise missiles that were used in the Saudi attack was too short to allow man in the loop operations. Unless of course the Iranians had new technology unknown to the west. If so, what was it?

There are four possibilities. These are: (1) completely autonomous drone operation not needing hot links back to a control center; (2) satellite links meaning that the drones could operate over very long distances; (3) a communications localizer of some kind, such as a transmitter-receiver located somewhere on Saudi Arabian territory or, alternatively, nearby; (4) or a more powerful onboard communications system.

Israel is convinced that Iran now has an autonomous system for its drones and cruise missiles, a system that is similar to the scene matching TERCOM that has long been part of the US Tomahawk cruise missile. In fact, the Israelis are concerned that the Iranians are supplying Hezbollah in Lebanon and Syria with these new generation missiles which is why Israel has been aggressively trying to destroy them in Syria and Lebanon. Iran showed off a new missile called Mobin on August 21, 2019 at the MAKS airshow in Zhukovsky, Russia. The Iranians claimed that Mobin by operating autonomously and stealthy in design could penetrate western air defenses. According to the information they provided, Mobin was equipped with TERCOM and DSMAC, a scene matching artificial intelligence capability.

A second possibility is a satellite link for the UAV. This would require a satellite transmitter and receiver. None of the recovered cruise missiles or UAVs show a satellite link transmitter-receiver.

A third possibility is a communications localizer of some kind. None has been found.

Finally a more powerful onboard transmitter-receiver is a possibility, but again there isn't any evidence of one.

If there was a TERCOM-enabled autonomous capability in the drones and cruise missiles used in the Saudi Arabian attacks then it is probable that surveillance drones were used some time ahead of the actual attack to carefully map the targets. That mapping information, including imagery would then be loaded into the onboard TERCOM system.

At minimum the Iranian attack must have involved a long run up to establish the targets and carry out the necessary weapon's programming.

Since some of the drones and cruise missiles used in the attack have been recovered, and we know for sure that their computers have been exploited, then it is reasonable to assume that US and other intelligence agencies know about Iran's new capability, although they have not told the public.

Conclusions

1.Conventional air defense systems, whether US, European or Russian do not reliably detect drones or cruise missiles. In particular, the weakness of the US Patriot system and the failure of multiple Russian air defenses including the S-300 and Pantsir suggest that all of them have to be augmented by a new generation of air defense systems for the battlefield and for infrastructure protection.

2.A key problem for designers is that at present the range of high definition radars needed for identifying UAVs and small cruise missiles is limited. This means that many such systems are needed to defend borders, bases and high value infrastructure. New technology is needed to significantly extend the range.

3.The rise of autonomous drones takes away one of the tools to defeat drones –namely communications jamming. While it still might be possible to blind a TERCOM system (for example with lasers), radio jamming of communications won't work. However, unless drones are equipped with accurate inertial guidance systems (for example ring laser gyros), the drones will need to rely on GPS. Efficient ways either to jam GPS or broadcast false parameters is a tool that has a future in combating drone attacks.

4.Today's drones that are low powered and made of plastic or composites are naturally radar evading. Optical scanning combined with thermal imaging offers potentially better range than high resolution radar and is a promising technology for future systems.

5.The US free and open policy on GPS needs reevaluation, especially GPS availability in hot spot areas. While there are other GPS systems in the world such as Russia's GLONASS and Europe's Galileo, the possibility of a deal to control GPS accuracy in certain world hot spots may be an approach that could yield tangible benefits. Thus a Satellite Security Arms Agreement (SSAA) ought to be on the agenda of US, European and Russian leaders.

6.Control of exotic, accurate gyroscopes ought to be made a policy priority. While these have proliferated in recent years it may be possible to limit the supply and availability.

NASA, US, European Partner Satellite Returns First Sea Level Measurements *(10 December, 2020)* *(Continued from Page 3)*

Sentinel-6 Michael Freilich will continue a decades-long effort to measure global ocean height from space, which started in the early 1990s. Since then, the rate of sea level rise has doubled with a current rate of 0.16 inches (4 millimeters) per year. The rise is caused almost entirely by a combination of meltwater from land-based glaciers and ice sheets and the fact that seawater expands as it warms.

"Data from Sentinel-6 Michael Freilich will help us evaluate how the Earth is changing," said Karen St. Germain, director of NASA's Earth Science Division. "When we combine the data from instruments like the altimeter on Sentinel-6 Michael Freilich with data from other satellites like GRACE-FO and IceSat-2, we can tell how much of the sea level rise is due to melting ice and how much is due to expansion as the oceans warm. Understanding these underlying physical mechanisms is what allows NASA to improve projections of future sea level rise."

The initial orbit for Sentinel-6 Michael Freilich was 11.4 miles (18.4 kilometers) lower than its ultimate operational orbit of 830 miles (1,336 kilometers) above Earth. Engineers plan to move the satellite into its operational orbit by mid-December, where it will trail the Jason-3 satellite by 30 seconds. During this tandem flight, scientists and engineers will spend the next six to 12 months cross calibrating the data collected by both satellites to ensure the continuity of measurements between the two. Once assured of the data quality, Sentinel-6 Michael Freilich will then become the primary sea level satellite. The first publicly available sea level data will be available in about six months, with the rest available within a year.

"We are now gearing up the operational systems supporting the processing of the instruments' data by EUMETSAT and partner organizations, as they are all contributing to this complex process," said Manfred Lugert, program manager for the Sentinel-6/Jason-CS (Continuity of Service) mission at the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT). "This will keep us busy for the next few months, as the independent scientific validation and fine tuning need to be undertaken very carefully." Lugert expects the first operational products from the mission would be available to those who need them by mid-2021.

In addition to measuring sea level, Sentinel-6 Michael Freilich is monitoring atmospheric temperature and humidity, which will help improve weather and hurricane forecasts. Engineers and scientists turned on that instrument Nov. 27, and the initial data look good.

More About the Mission

Sentinel-6 Michael Freilich is named in honor of the former director of NASA's Earth Science Division, who was a leading figure in advancing ocean observations from space. Freilich passed away Aug. 5, 2020. "I think he would be proud," said Willis. "Like Mike himself, we expect great things from the satellite that bears his name, and so far, it's looking good."

The spacecraft is one of two identical satellites that will extend a nearly 30-year sea level record collected by an ongoing collaboration of U.S. and European satellites by another decade. That record began in 1992 with the TOPEX/Poseidon satellite and continued with Jason-1 (2001), OSTM/Jason-2 (2008), and Jason-3, which has been observing Earth's oceans since 2016. Sentinel-6 Michael Freilich will pass the baton to its twin, Sentinel-6B, in 2025.

Both spacecraft are a part of the Sentinel-6/Jason-CS mission, which will collect accurate measurements of sea surface height for more than 90% of the world's oceans. The satellites will also monitor atmospheric temperature and humidity, as well as wave height and wind speed, which will provide crucial information for operational oceanography, marine meteorology, and climate studies.

ESA (European Space Agency), EUMETSAT, NASA, and the National Oceanic and Atmospheric Administration (NOAA) are jointly developing the Sentinel-6/Jason-CS mission, with funding support from the European Commission and support from France's National Centre for Space Studies (CNES). The mission is part of Copernicus, the European Union's Earth observation program, which the European Commission manages.

NASA's contributions to the Sentinel-6/Jason-CS mission are three science instruments for each of the two satellites: the Advanced Microwave Radiometer for Climate, the Global Navigation Satellite System - Radio Occultation, and the Laser Retroreflector Array. NASA also contributed launch services, ground systems supporting operation of the NASA science instruments, the science data processors for two of these instruments, and support for the U.S. members of the international Ocean Surface Topography Science Team. NASA's Jet Propulsion Laboratory at the California Institute of Technology in Pasadena manages the agency's contribution to the mission.

For more information, visit:
https://www.nasa.gov/sentinel-6
https://www.esa.int/Sentinel-6
https://edefis.eu/CopernicusFactsheets

Hamas aims precision cruise missiles at Israel (Continued from Page 5)

Today commercial GPS is commonly available to nearly anyone and anywhere. Computers are far better as well and cheap. China and Russia have TERCOM type targeting systems at least as accurate as Tomahawk (which they emulated). Iran did not have these systems until 2019.

Israel has been preparing for the past year in anticipation that Iran and its proxies (Hezbollah and Hamas) would be able to field precision autonomous cruise missiles. Under a new plan called "Momentum" Israel is now focused on eliminating missile bases and manufacturing sites. It has already destroyed a number of them in Lebanon and Syria in the past year. Israel has also set up an "Iran Command." The plan seeks to leverage Israel's weapon's lethality, intelligence, cyber-warfare and aerial superiority.

One of the major challenges is to try and stop the smuggling of weapons from Iran and Syria. In regard to Gaza, weapons arrive by sea on small craft, and parts for local manufacturing are smuggled through tunnels in the Sinai which is under Egyptian control. Just as the Houthis have produced cruise missiles and rockets with Iranian assistance, what Lieberman is saying is that the same thing is happening in Gaza.

Iran has sought plausible deniability so it has its proxies assemble weapons that are materially different from front line Iranian ones. For example, Quds-1 is a smaller version of Iran's Soumar cruise missile. Soumar, in turn, is a knock off of the Russian KH-55. When Iran attacked two Saudi Oil centers in September, 2019 four Quds-1 cruise missiles hit the Khurais oil field where they accurately struck storage tanks, stunning American observers. (At Abqaiq, the other attack site, suicide UAV's were used.) The US Patriot air defense system failed to detect the missiles.

When the Quds-1 were recovered they appeared similar to drones used by the Houthis. They all used a small jet engine based on the Czech TJ-100 but manufactured in Iran (rebranded T-10). The Soumar uses either a Russian or a Chinese engine. The Iranians were trying to deflect responsibility for the attack, something they followed up by having the Houthis claim it was their Quds missiles that carried out the attack.

For some months now, Hezbollah in Israel's north has been launching drones to photograph targets in Israel, likely preparing for cruise missile attacks. Hamas also has both surveillance and armed drones and a few have been launched into Israeli territory.

The US is also very concerned about cruise missile attacks and is planning its new tactical air defense system to be able to knock out cruise missiles and drones. The US Army is working on an Integrated Air-and-Missile Defense System capable of knocking out short range rockets and cruise missiles.

The arrival of precision type weapons, whether man in the loop as used in the Nagorno-Karabakh conflict, or autonomous as seen in Saudi Arabia, is a new kind of warfare that requires innovative defensive systems and new military doctrine. The clock can no longer be rolled back or access to the technology prevented.

**Russia MAKS 2019, Intel exhibition, Iran "Mobeen" cruise missile: https://youtu.be/P28FwaVisdY*

Dr. Stephen Bryen has 50 years of experience in government and industry. He has served as a senior staff director of the U.S. Senate Foreign Relations Committee, as the Executive Director of a grassroots political organization, as the head of the Jewish Institute for National Security Affairs, as the Deputy Under Secretary of Defense for Trade Security Policy, as the founder and first director of the Defense Technology Security Administration, as the President of Delta Tech Inc., as the President of Finmeccanica North America, and as a Commissioner of the U.S. China Security Review Commission. Currently Dr. Bryen is a Senior Fellow at the American Center for Democracy and on the Board of Directors of Il Nodo di Gordio. He writes regularly for Asia Times.

Biography

The author publishes his technology, policy and strategy blog, ***Bryen's Blog*** *(www.bryensblog.com), a popular site for decision makers in government, the military and industry. He has published five books. The latest is* ***Volume III*** *of* ***Essays in Technology, Security and Strategy*** *and a book on security for religious organizations called* ***Security for Holy Places*** *(Morgan James Publishing). His writing has earned praise worldwide.*

BepiColombo (ESA-JAXA Spacecraft) (Continued from Page 8)

Firsts

•ESA's first mission to Mercury
•JAXA's first mission to Mercury
•First mission to Mercury comprised of two orbiters

In Depth: BepiColombo

BepiColombo is a joint European-Japanese mission to Mercury to study the planet's composition, geophysics, atmosphere, magnetosphere and history.

The European Space Agency (ESA) and the Japan Aerospace Exploration Agency (JAXA) are each sending an orbiter on the same spacecraft.

ESA built the main spacecraft, the Mercury Planetary Orbiter (MPO), and JAXA supplied the Mercury Magnetospheric Orbiter (MMO).

MPO will study the surface and internal composition of the planet, and MMO will study Mercury's magnetosphere, that is the region of space around the planet that is dominated by its magnetic field.

ESA and JAXA announced in April 2019 that BepiColombo had successfully completed its near-Earth commissioning phase and was ready for its long cruise to Mercury, which will include flybys of Earth and Venus.

A few months before arriving at their destination, the spacecraft's transfer module will be jettisoned leaving the two orbiters—still connected to each other—to be captured by Mercury's gravity.

The orbiters will arrive at Mercury in 2021 and will make several flybys before entering orbit Dec. 5, 2025.

Both orbiters are expected to operate for about one year.

BepiColombo is only the third spacecraft to visit Mercury. NASA's Mariner 10 flew past Mercury three times in 1974-1975 and returned the first close-up images of the planet.

NASA's MESSENGER orbited Mercury for more than four years from Aug. 3, 2004, to April 30, 2015. The mission determined Mercury's surface composition, revealed its geological history, discovered details about its internal magnetic field, and verified its polar deposits are dominantly water-ice. The mission ended when MESSENGER ran out of fuel and slammed into Mercury's surface.

BepiColombo is named after Professor Giuseppe (Bepi) Colombo (1920-1984) from the University of Padua, Italy, a mathematician and engineer. He was the first to determine that an unsuspected resonance is responsible for Mercury's habit of rotating on its axis three times for every two revolutions it makes around the Sun.

Key Sources

European Space Agency: BepiColombo
Japan Aerospace Exploration Agency: BepiColombo
National Space Science Data Center Master Catalog: BepiColombo

AIAA LA-LV Online Gallery *(Screenshots only)* (Continued from Page 10)

https://aiaa-lalv.org/gallery/

Gallery-Aerospace

(Please click the image or the name to see the gallery and bio)

Mr. Aldo Spadoni

Ms. Michelle Rouch

Col. Mark Pestana

https://aiaa-lalv.org/gallery/gallery-aerospace-art/

Gallery-Photography

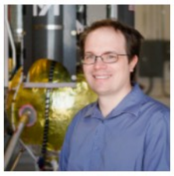
(Please click the image to enter the gallery. Thank you!)

Mr. André Bormanis

Ms. Michelle Evans

Dr. Henry B. Garrett

Dr. Jeffrey Puschell



Mr. Matthew Kuhns

Mr. Daniel Adamo

Col. Mark Pestana

Prof. Madhu Thangavelu

https://aiaa-lalv.org/gallery/gallery-photography/

Israel's multilayer air defense system a new age missile-killer (From Page 11)

The major problem for air defense operators has been detection at range for low flying cruise missiles and drones. Radars can easily detect small objects – radar guns are used to measure baseball speed – but they are range limited because of the prevalence of ground clutter that shrouds the incoming object.

And because a radar could easily confuse a friendly object with one that is a threat, modern air defense systems need to be able to classify objects and identify them as threats. In the case of an integrated system, that classification capability also implies that the appropriate segment of the air defense system will be assigned to respond to the threat.

We don't know much about what improvements the Israelis have made in their air defenses to account for cruise missiles and drones. But we can speculate that the improvements are largely in radar image processing and in discernment algorithms.

The two main systems in Israel's arsenal to deal with these kinds of threats are called Iron Dome – *Kippat Barzel* in Hebrew – and David's Sling – *Sharvit Haksamim*, or the Magic Wand, in Hebrew.

A battery of Israel's Iron Dome defense system, designed to intercept and destroy incoming short-range rockets and artillery shells, in Mount Hermon in the Israeli-annexed Golan Heights on January 21, 2019. Photo: AFP/Jalaa Marey

Iron Dome has been remarkably successful against small rockets, especially those fired from Gaza. The system can also knock out mortar rounds. Iron Dome accounts for 1,500 to 2,000 kills on rockets fired from Gaza into Israeli territory.

One of Iron Dome's unique features is that it selects only those threats that are likely to cause harm, letting rockets that won't hit villages or infrastructure to fall to the ground. This saves interceptor rockets for meaningful kills, saves money and optimizes the chance to deal with "swarming" type attacks, like what hit Saudi Arabia's oil fields.

The limitation of the Iron Dome system is its coverage area. Each Iron Dome battery can cover about 150km of territory.

David's Sling is a much heavier air defense system that is replacing the US Patriot and Hawk air defense systems. It is optimized to cover incoming threats at distances of between 40km to 300km.

David's Sling is a joint development of Rafael Advanced Defense Systems in Israel and Raytheon in the United States. The system uses an Israeli radar made by Elta, EL/M-2084, an active electronically scanned array multi-mode radar. The radar linked to the air defense system is capable of selecting real targets from decoys.

It was designed to deal with Russian Iskander missiles and Chinese DF-15 short-range ballistic missiles that have maneuvering re-entry vehicles. The system can also deal with a variety of other Russian, Chinese and North Korean missiles – and respective Iranian knock-offs – such as the Tochka, which is in large numbers in Syria and Yemen.

The top tier of Israel's air defense system is Arrow 2 and Arrow 3. Arrow 3 is an exoatmospheric capable system that can even knock out enemy satellites.

What became clear in the attacks on Saudi Arabia and in the Nagorno-Karabakh war was that radars were ineffective in detecting even large drones like Turkey's Bayraktar.

A handout picture released by Israel on December 10, 2015, shows the launch of an Israeli Arrow 3 missile at an undisclosed location in southern Tel Aviv. Photo: AFP/Israeli Defense Ministry

While some of this can be attributed to difficult terrain, it also indicates that both Russian and Western radars were ineffective against relatively slow-flying threats coming in at a low altitude.

(Continued on the next page)

Israel's multilayer air defense system a new age missile-killer

(Continued from the previous page)

It is likely these systems do not have sophisticated computers to sort out real radar returns from ground clutter and they may also lack threat libraries that anticipate undocumented cruise missiles and drones.

Cruise missiles in their terminal flight envelope may fly as low as 15 meters above the ground.

The successful Israeli test and demonstration takes up an issue of contention between the US Army and Israel over Israel's ability to knock out cruise missiles. When the US Army bought two Iron Dome systems from Israel, which the US Congress mandated, Israel claimed the system could deal with a range of threats including cruise missiles and drones.

Until now, Israel could not prove in any conclusive manner they were able to counter a cruise missile attack. It is likely Israel was also in the process of improving and optimizing Iron Dome and David's Sling against advanced drone and cruise missile threats.

Israel's military has been aggressively taking out Iranian supplied rockets and cruise missiles shipped into Syria, Lebanon and Iraq and, no doubt, Israel anticipates that even with these efforts the threat to Israeli territory is real and growing.

With these tests showing Israel's Iron Dome can kill drones and cruise missiles, one of the key US Army arguments about Iron Dome's "limitations" is in the process of being erased.

The other argument, about the availability of source code – which Israel allegedly resists providing – relates more to the algorithms Israel's Defense Forces have developed to assure these new types of threats can be countered rather than hardware advances. How to bridge this gap with the US remains an issue still on the table.

Source code is the computer instruction set of commands that operates the air defense system.

For Israel, these algorithms in the source code represent high-level secrets that go beyond industrial security and are critical to the national security of the country. How this gap can be bridged is a challenge for both sides, but it is clear that a creative effort would help the US Army field a competent system.

Dr. Stephen Bryen has 50 years of experience in government and industry. He has served as a senior staff director of the U.S. Senate Foreign Relations Committee, as the Executive Director of a grassroots political organization, as the head of the Jewish Institute for National Security Affairs, as the Deputy Under Secretary of Defense for Trade Security Policy, as the founder and first director of the Defense Technology Security Administration, as the President of Delta Tech Inc., as the President of Finmeccanica North America, and as a Commissioner of the U.S. China Security Review Commission. Currently Dr. Bryen is a Senior Fellow at the American Center for Democracy and on the Board of Directors of Il Nodo di Gordio. He writes regularly for Asia Times.

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NASA, Canadian Space Agency Formalize Gateway Partnership for Artemis Program

(Continued from Page 17)

In October, NASA and ESA (European Space Agency) signed an agreement solidifying ESA's contributions to the Gateway to provide habitation and refueling modules, along with enhanced lunar communications and service modules for Orion. In March, NASA selected the first two scientific investigations to fly aboard the Gateway, one from NASA and the other from ESA. ESA developed the European Radiation Sensors Array, or ERSA, and NASA's Goddard Space Flight Center is building the Heliophysics Environmental and Radiation Measurement Experiment Suite, or HERMES. The two mini space weather stations will split the work, with ERSA monitoring space radiation at higher energies with a focus on astronaut protection, while HERMES monitors lower energies critical to scientific investigations of the Sun. All of the Gateway's international partners will collaborate to share the scientific data that will be transmitted to Earth. Additional scientific cooperative payloads will be selected to fly aboard the outpost.

In addition to supporting lunar surface missions, the Gateway will support activities that will test technologies needed for human missions to Mars. Using the Gateway, NASA will demonstrate remote management and long-term reliability of autonomous spacecraft systems and other technologies.

Learn more about NASA's Gateway program at:

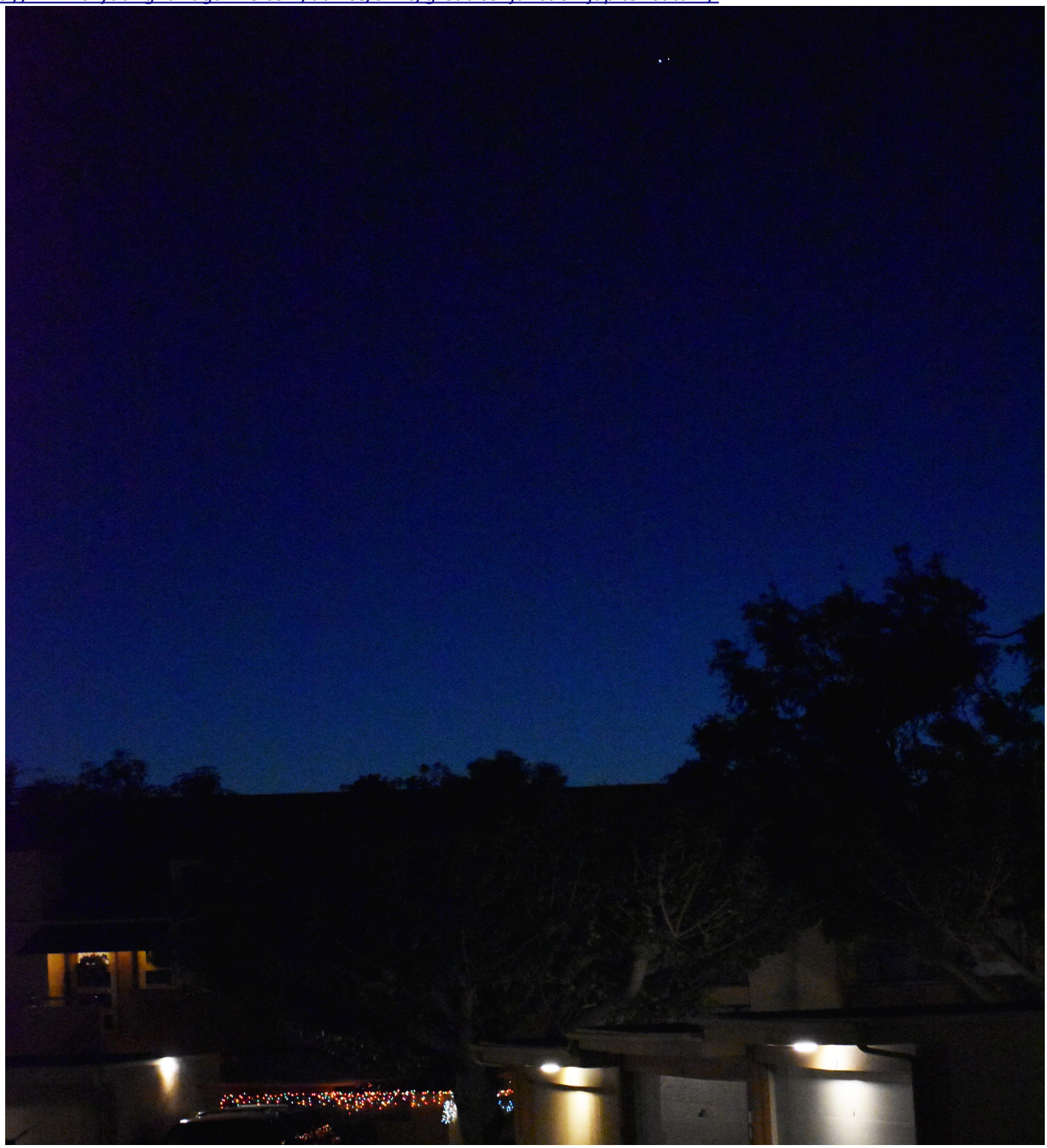
https://nasa.gov/gateway

Learn more about NASA's Artemis program at:

https://www.nasa.gov/artemis

Gallery 1-1 – Michelle Evans: Jupiter and Saturn Conjunction

Jupiter and Saturn Conjunction in December, 2020:
https://www.skyatnightmagazine.com/advice/skills/great-conjunction-jupiter-saturn/



The camera is a Nikon D5600 at ISO 25,600.
The wide angle view was taken on 21 December at f6.3 and 1/90th of a second exposure at 70mm.
The direction was to the west southwest.
(Courtesy of Ms. Michelle Evans, AIAA Distinguished Lecturer, https://aiaa-lalv.org/september-28-2020-aiaa-member-spotlight-on-michelle-evan/)

Gallery 1-2 – Michelle Evans: Jupiter and Saturn Conjunction

Jupiter and Saturn Conjunction in December, 2020:
https://www.skyatnightmagazine.com/advice/skills/great-conjunction-jupiter-saturn/

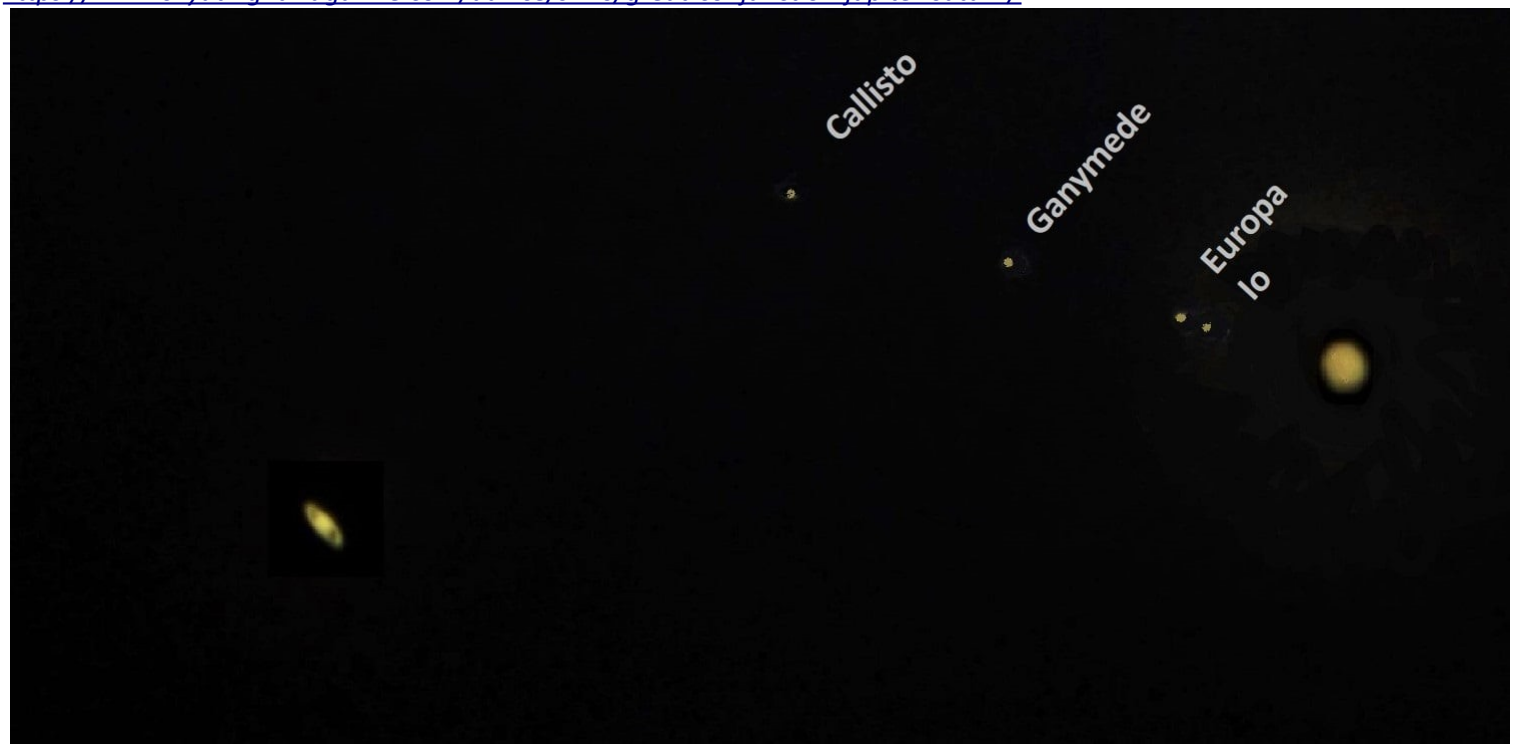
The camera is a Nikon D5600 at ISO 25,600. The close up of Jupiter and Saturn was taken from 14 December to 21 December at f6.3 and 1/250th of a second exposure at 300mm. The direction was to the west southwest. (Courtesy of Ms. Michelle Evans, AIAA Distinguished Lecturer, https://aiaa-lalv.org/september-28-2020-aiaa-member-spotlight-on-michelle-evan/)

Gallery 1-3 – Michelle Evans: Jupiter & Saturn Conjunction, Moon

21 December, 2020 (Courtesy of Ms. Michelle Evans, AIAA Distinguished Lecturer, https://aiaa-lalv.org/september-28-2020-aiaa-member-spotlight-on-michelle-evan/)

Gallery 2-1 – Mark Pestana: Jupiter and Saturn Conjunction, Moon

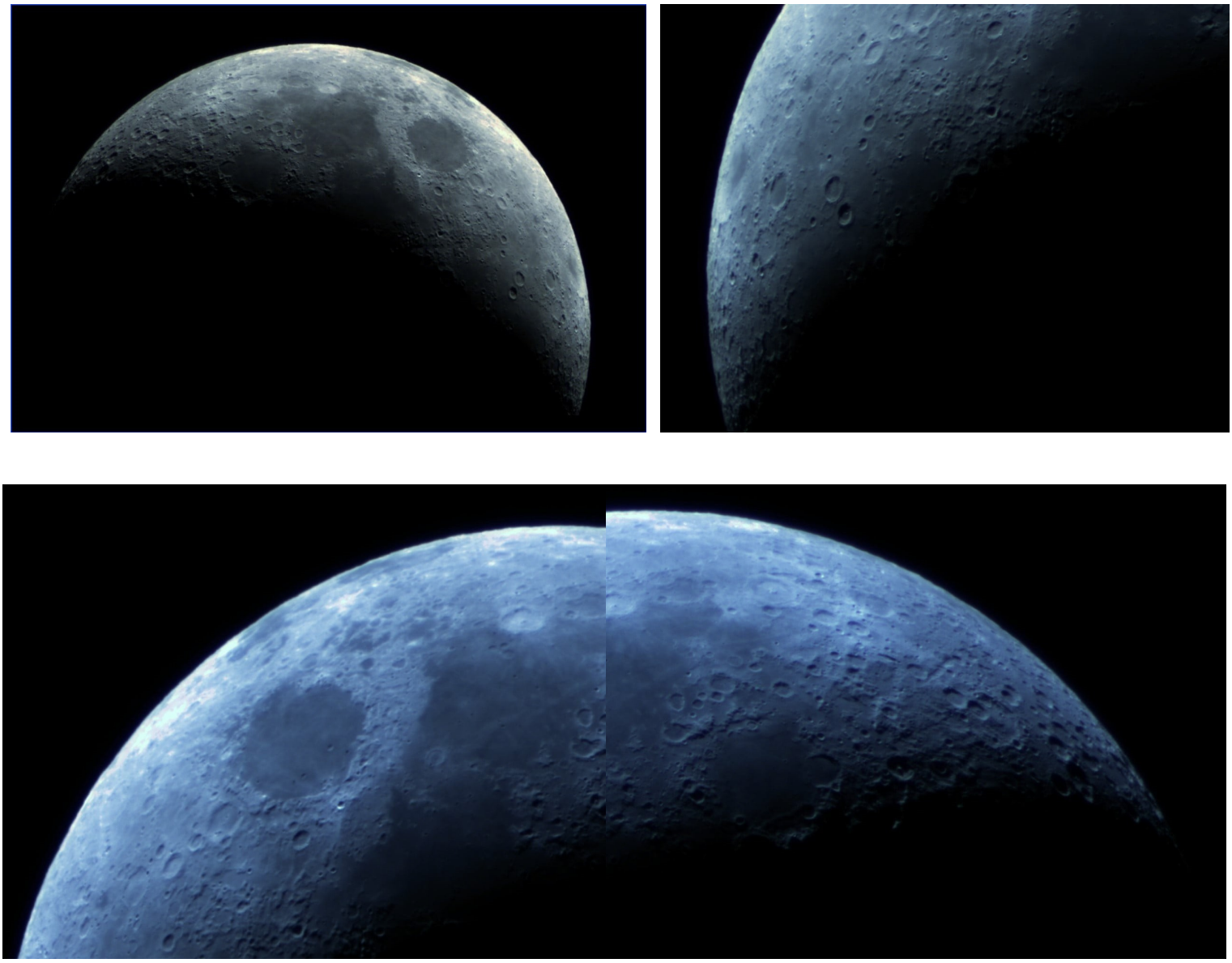
Jupiter and Saturn Conjunction in December, 2020:
https://www.skyatnightmagazine.com/advice/skills/great-conjunction-jupiter-saturn/



Images taken with Celestron NEXSTAR 120GT, with Meade Color CCD Camera, SkyCapture software. (raw images, no color correction...yet). Location Bear Valley Springs, Tehachapi Mountains, California. Elevation 4200 ft. (19 December) (Col. Mark Pestana: https://aiaa-lalv.org/august-31-2020-aiaa-la-lv-member-spotlight-on-col-mark-pestana/)

(21 December, 2020)

Gallery 2-2 – Mark Pestana: Jupiter and Saturn Conjunction, Moon



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Gallery 3 – Madhu Thangavelu: Jupiter/Saturn & Moon

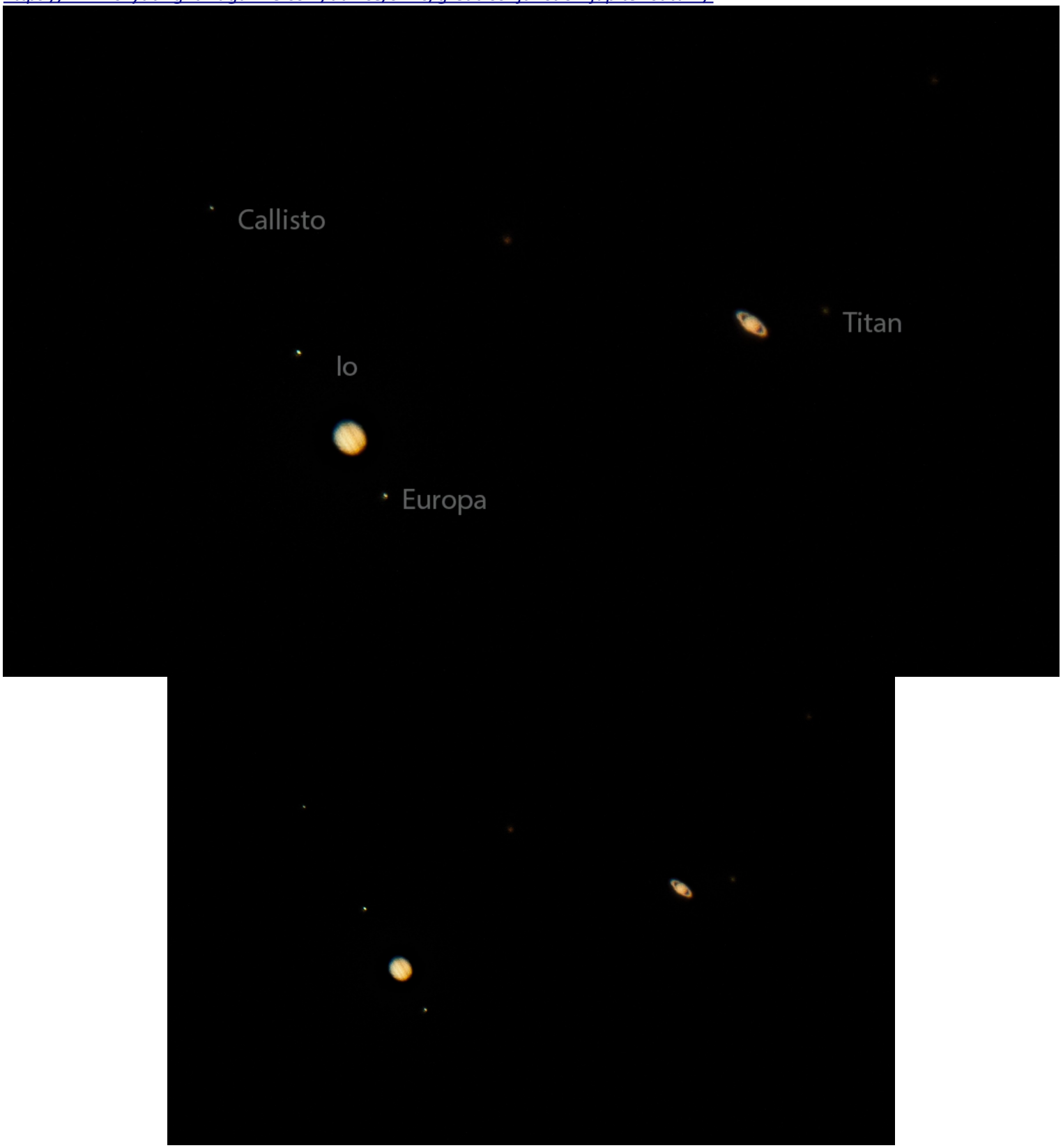
Jupiter and Saturn Conjunction in December, 2020:
https://www.skyatnightmagazine.com/advice/skills/great-conjunction-jupiter-saturn/

Camera: Leica D-LUX 4, 1/8 second manual exposure (17 December) (Prof. Madhu Thangavelu)

Taken with an iPhone7Plus (21 December) (Prof. Madhu Thangavelu)

Gallery 4 – Matthew Kuhns: Jupiter and Saturn Conjunction

Jupiter and Saturn Conjunction in December, 2020:
https://www.skyatnightmagazine.com/advice/skills/great-conjunction-jupiter-saturn/



(Courtesy: Matthew Kuhns: https://aiaa-lalv.org/june-15-2020-aiaa-member-spotlight-on-matthew-kuhns/)

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

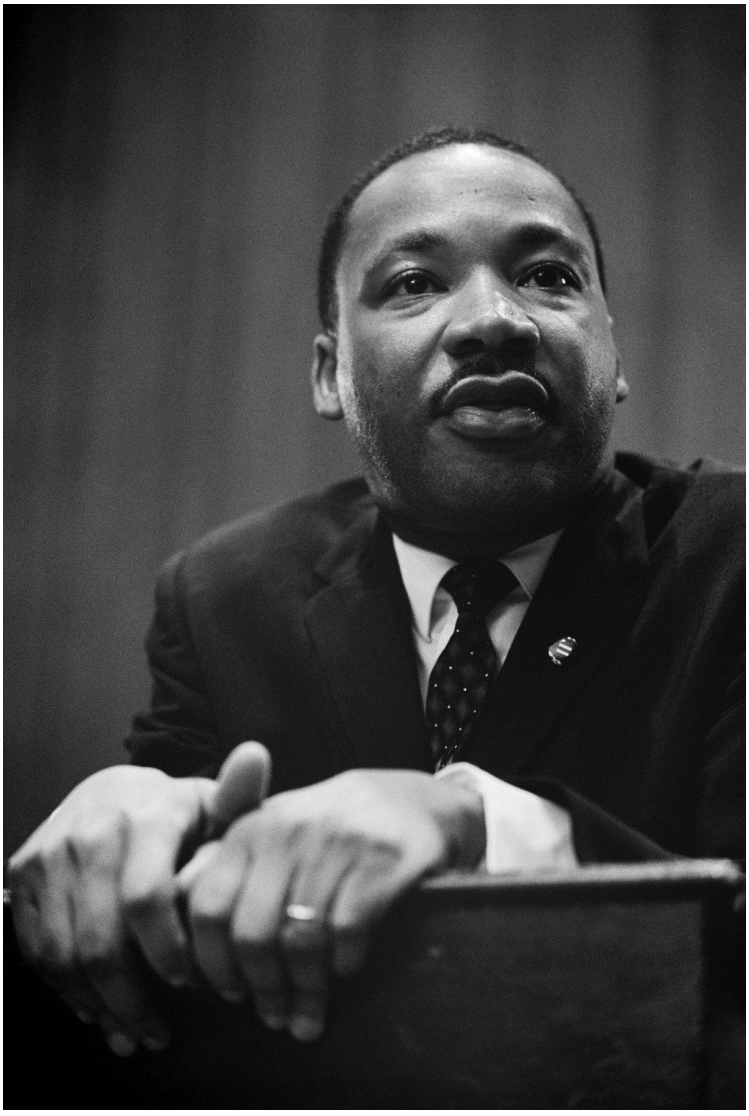
Monday, January 18, 2020, 10 AM PST (Add to Calendar)

AIAA LA-LV Celebrates Dr. Martin Luther King Jr. Day

RSVP and Information: https://conta.cc/3n0VIXW

The American Institute of Aeronautics and Astronautics, Los Angeles-Las Vegas Section, will present, "A Day of Celebration in Honor of Rev. Dr. Martin Luther King Jr.," online on Zoom.

This event celebrates Dr. King—the man, the minister, and the humanitarian. Come and join us to celebrate this auspicious day, and enjoy the discussion among African American and other minorities in aerospace / STEM fields, and possible some readings of Dr. King's words.



Frederick Beck
Group Supervisor, Cybersecurity Ops & Identity Mgmt at JPL (NASA's Jet Propulsion Laboratory)

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

Victor Lewis Cook
MBAA/MAS/BSASQ Certified Quality Auditor
AS9100D Lead Auditor Certified
FAA Certified Airframe & Power Plant Technician

Michelle Evans
Author, Bestseller "The X-15 Rocket Plane, Flying the First Wings into Space"
Founder and President, Mach 25 Media (www.Mach25Media.com)
AIAA Distinguished Lecturer
Writer, Photographer, and Communications Specialist in aerospace

Douglas Ikemi
Independent Engineer

Tyrone Jacobs Jr.
Northrop Grumman

Jesse Modesto
CalPoly Pomona (2018)

Mike Wallace
Raytheon

(+a Civilian Airman To Be Announced)

(More TBD)

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

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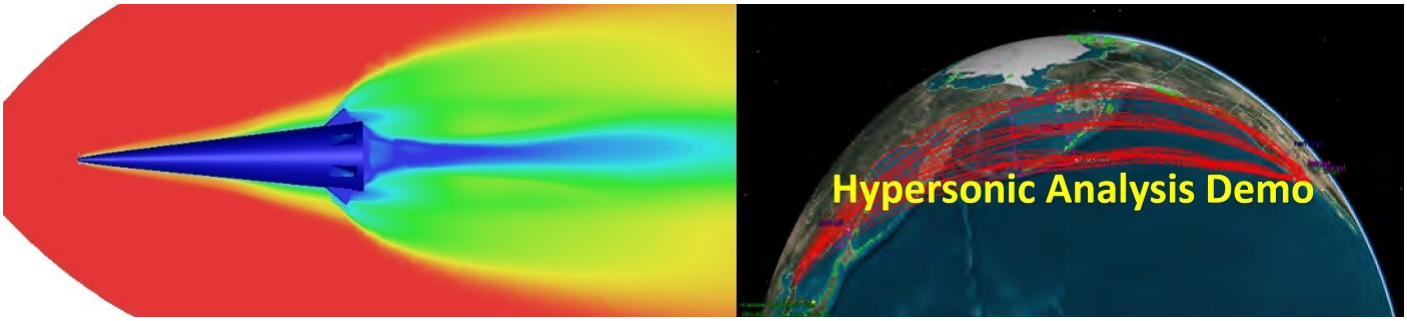

RSVP and Information: *https://conta.cc/2KpolL3*

Saturday, Janaury 23, 2021, 10 AM PST (Add to Calendar)

AIAA LA-LV e-Town Hall Meeting 1/23

(Part I)

Addressing the Challenges of the Design of Hypersonic Vehicles with Simulation

by

Dr. Swati Saxena

Technical and Project Manager
ANSYS Inc.

(Part II)

Parsons Digital Engineering Framework (PDEF) Hypersonic Demonstration

by

Mr. Stephen Thomas

Program Assessments Lead, Complex Technical InvestigationsLeadership supporting critical national security projects in air, missile, and space defense,
Parsons

Tentative Agenda (All Time PST) (Pacific Standard Time, US and Canada)
10:05 am: Dr. Chandrashekhar Sonwane (Welcome, AIAA LA LV Section Chair)
10:10 am: Dr. Swati Saxena (ANSYS)
11:40 am: Mr. Stephen Thomas (Parsons)
01:10 pm: Adjourn

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

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

Saturday, January 30, 2021, 10 AM PST (Add to Caldendar)

AIAA LA-LV e-Town Hall Meeting 1/30

Space Settlement: an Easier Way

by

Al Globus

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

RSVP and Information: https://conta.cc/3a2tc5f

Tentative Agenda (All Time PST) (Pacific Standard Time, US and Canada)
10:05 am: Dr. Chandrashekhar Sonwane (Welcome, AIAA LA LV Section Chair)
10:10 am: Mr. Al Globus
11:40 am: (TBD)
01:10 pm: Adjourn

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

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

Saturday, February 6, 2021, 10 AM PST (Add to Caldendar)

AIAA LA-LV e-Town Hall Meeting 2/6

Beyond the Black Box:

The Forensics of Airplane Crashes

by

Prof. George Bibel

AIAA Distinguished Lecturer,

Professor of Mechanical Engineering at the University of North Dakota

RSVP and Information: https://conta.cc/3adhkNQ

Tentative Agenda (All Time PST) (Pacific Standard Time, US and Canada)
10:05 am: Dr. Chandrashekhar Sonwane (Welcome, AIAA LA LV Section Chair)
10:10 am: Prof. George Bibel (University of North Dakota)
11:40 am: (TBD)
01:10 pm: Adjourn

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