Lessons from the mind that guided the creation of the F-35
by Larry Grooms, special to Aerotech News, on 22 October, 2020 (with permission) (on an AIAA LA-LV Oct. 10 talk)

(Left) A Lockheed Martin Joint Strike Fighter (F-35 Lightning II) flies over Edwards Air Force Base, Calif. (Courtesy photograph) (Right) Dr. Paul Bevilaqua, AIAA Fellow & AIAA Distinguished Lecturer. (Courtesy photograph)

When the veils are lifted from Lockheed Martin’s invention of the Joint Strike Fighter, the wizard-in-chief is revealed to be a man who could speak, interpret and organize the language of aerospace specialties.

Although Dr. Paul Bevilaqua, the man behind the curtain as former chief engineer for the Lockheed Martin Skunk Works, has told the story of the XF-35 invention many times to industry groups, he reached a wider audience Oct. 10 in an online webinar produced by the American Institute of Aeronautics & Astronautics Los Angeles/Las Vegas Section.

Bevilaqua explained the challenge in creating the Joint Strike Fighter was performing a modern miracle by designing a multi-role, single engine air superiority fighter capable of both vertical and short field takeoff and landing and achieving supersonic speed. And the level of difficult rose a few notches with requirements that the new fighter would meet the mission requirements of the U.S. Air Force, Navy and Marine Corps, as well as defense forces of friendly nations. And the final product had to be thrifty.

(Continued on Page 30)
The Big 3 Enablers for Sustainment Management: People, Process, Data
by Col. Charles Vono (USAF & TRW Retired), AIAA Distinguished Lecturer, AIAA Associate Fellow

We started in article 1 with a very short history of complex systems, system sustainment, and a discussion of how the ICBM team used these concepts to keep Minuteman ICBMs meeting their mission for over half a century.

Article 2 provided an overview of this management model and some definitions. Article 3 explained how your risk management system is different from any other risk management system in a sustainment organization. Article 4 explained the need for on-going observation of your entire system to ensure affordable and effective assessment of emerging failure modes. Article 5 addressed execution of risk mitigation fixes to your system and the previous article explained why and how you need to institute a unique methodology into your repair depots to ensure emerging failure modes are discovered.

This article covers the 3 “enablers” that management must pay close attention to when executing sustainment of a complex system. These enablers are: People, Process, and Data.

People in a sustainment organization must be courageous leaders no matter their position in the organizational chart. When they see something odd, they pursue it and advertise it. They are not discouraged by skeptics or timid managers.

Processes are created, religiously followed, and improved. Degradation trends can cover decades, so lack of process means lack of consistency and an inability to discern weak patterns.

Data comes in terabytes in today's complex systems. It must be captured, organized, and exploited by skilled assessors using powerful tools while using consistent processes.

People, processes, and data form a decades-long dance of creation, improvement, and complexity. Just as in spiral software development, tools start out simple but meet a pressing need. As knowledge and skills grow, the processes and tools grow with them. People and their skills are treasured. Managers generally say “yes” to tool improvement. Processes, not people, are reviewed, criticized, and refined.

Conversely, managers who stop this process at any point are doing damage to their ability to observe, and thus sustain, their system. Be careful when refusing tool upgrades, data preservation, or training. Make very sure that any process change suggested by your people is vetted quickly and the change is made, absent any obvious problems. This cannot take longer than 2 weeks and should be completed much sooner – ideally within 3 days. Quell fears by reminding people that mistakes can be found and corrected just as fast.

These are not easy rules to follow in the heat of the moment. Servant leadership, active listening, and an innate desire to step outside your box every day are habits that help.

As always, more information can be found on these topics at my web site: charlesvono.com
North Korea Military Parade (Mid-Night), October 2020
by Mike Gruntman, Professor of Astronautics at USC, astronauticsnow.com (11 October, 2020, with permission)
https://www.youtube.com/watch?v=aXQy2UaqjU

Newest bigger mobile liquid-propellant Intercontinental Ballistic Missiles (ICBM). Note 11-axle transporter compared to 9-axle transporter of Hwasong-15 ICBM.

See these developments yourself instead of relying on utterly politicized “enlightened” media (with a few exceptions). Without commentary.

The fragments of the parade follow, courtesy of nknews.org.

Somebody has to watch the entire event – then you do not have to.

In December 2012, North Korea launched its first artificial satellite of the Earth.

Then, many “talking heads” in the enlightened media and self-described “pundits” jeered at the successful launch and played down its impact.

Analysis of the 2012 launch at
https://youtu.be/ve4mL1Ebbak

North Korea – DPRK
October 9, 2020

Military Parade

75th anniversary of Workers’ Party

The military parade in October 2020 demonstrated significant improvements in personal equipment and conventional arms of the DPRK armed forces.

One can also see major advances in antitank and air defense systems and short range missiles.

A display of intercontinental ballistic missiles (ICBM) and intermediate range ballistic missiles (IRBM) shows steady progress.

https://youtu.be/ve4mL1Ebbak

(Continued on Page 31)
The Military Lessons of Nagorno Karabakh
by Dr. Stephen Bryen, Former Deputy Under Secretary of Defense (with Permission)


If you have a look at the video put out by the Azerbaijan Defense Ministry and at other photos taken in and around Shusha it is clear the city has fallen without any need for heavy artillery, rocket or even drone attacks that have otherwise characterized the Nagorno-Karabakh conflict.

For all intents and purposes the Nagorno-Karabakh war will end in not much more than a week to ten days and Azerbaijan will retake all or most of the territory it lost to Armenia in 1991-1992.

Shusha is the key to the victory, but once Azeri forces took the Lachin corridor and controlled the only road from Armenia into Shusha, the fall of Shusha was the certain result, since without supplies the remaining "army" holding the city could not fight.

Part of the reason the road was cut was that a key bridge connecting Armenia to Shusha was knocked out by a precision Israeli missile called LORA (for LOng RAnge). Without the bridge, even if it wanted to do so, Armenia could not move supplies or troops to relieve Shusha, nor could it pull troops out before they were trapped.

Unlike the Russian supplied missiles in the hands of the Armenians and Azerbaijanis, or artillery supplied to both sides, none of those weapons were accurate enough to do much more than strike terror into civilian populations. LORA appears to have changed the game for the defense of Shusha.

Drones, which are accurate unfortunately do not carry heavy enough explosives to take out major infrastructure.

For example the Roketsan MAM-L rocket used on Turkish Bayraktar TB2 drones weighs 21.5 kg (47 pounds) --when you subtract the rocket’s case, and propellant the warhead size is considerably smaller. Comparatively, LORA's warhead is 570 kg (1,256 pounds).

The last step in the war will be Stepanakert. This small city with a population of less than 60,000, served as the capital of the so-called Artsakh Republic. Artsakh was not recognized by any country other than Armenia that backed its creation.

There has been a huge exodus of people from Stepanakert, especially in the last few days. While we don’t know for sure, it is likely that many of the Armenian fighters will also pull out.

During the previous war, Nagorno-Karabakh was captured by Armenian forces as were a number of adjacent territories that clearly were Azerbaijani, including territory along the border with Iran. Armenia never handed back these lands and carried out ethnic cleansing in them as they did in Nagorno-Karabakh. Last week the Armenian-held Azerbaijani towns along the Iranian border including Fuzuli, Hadrut, Jabrayi, Gubadli and Zangilan were captured by Azeri forces.

On November 9th Azeri forces shot down a Russian Mil Mi-24 helicopter gunship piloted by two Russians who were killed. The attack helicopter was over Armenian territory but very close to the border. The Azerbaijan government immediately apologized to the Russians and the Russians said they would investigate.

(Continued on Page 32)
Wokeists Assault Space Exploration

Authors of paper submitted to NASA committee warn against human space exploration — and of putting “violent colonial practices” into orbit

by Dr. Robert Zubrin, President, The Mars Society (with Permission)


In October 2020, NASA’s Planetary Science and Astrobiology Decadal Survey committee received a manifesto from its Equity, Diversity and Inclusion Working Group (EDIWG). Written by NASA Ames Research Center public-communications specialist Frank Tavares — along with a group of eleven co-authors including noted activists drawn from the fields of anthropology, ethics, philosophy, decolonial theory, and women’s studies — and supported by a list of 109 signatories, “Ethical Exploration and the Role of Planetary Protection in Disrupting Colonial Practices” lacks technical merit. It is, nevertheless, of great clinical interest, as it brilliantly demonstrates how the ideologies responsible for the destruction of university liberal-arts education can be put to work to abort space exploration as well.

With praiseworthy clarity as to their bias and intent, the EDIWG authors say that human space exploration must be stopped because it represents a continuation of the West’s tradition of resource development through free enterprise. “All of humanity is a stakeholder in how we, the planetary science and astrobiology community, engage with other worlds,” they say, “Violent colonial practices and structures — genocide, land appropriation, resource extraction, environmental devastation, and more — have governed exploration on Earth, and if not actively dismantled, will define the methodologies and mindsets we carry forward into space exploration. . . . It is critical that ethics and anticolonial practices are a central consideration of planetary protection. We must actively work to prevent capitalist extraction on other worlds, respect and preserve their environmental systems, and acknowledge the sovereignty and interconnectivity of all life.”

The EDIWG authors are equally clear as to the means by which human space exploration and development can be stopped: the “planetary protection” bureaucracy.

“Our primary recommendation is . . . developing planetary protection policies . . . to establish a robust reevaluation of the ethics of future crewed and uncrewed mission to the Moon, Mars, and other planetary bodies with the intention of developing anticolonial practices.” [Bold type in original]

“Planetary protection” was originally proposed for two purposes. One was to assure that life-detection experiments sent to other worlds did not return false positives resulting from the transport of terrestrial microbes along with the spacecraft. The other was to avert the possibility that dangerous microbes from other worlds might be transported back to Earth. These two contingencies are known as forward and back contamination, respectively.

The risk of back contamination — by disease organisms returned by Mars missions in particular — is the planetary-protection concern that generates most of the coverage in popular journalism and entertainment media. However, it has no rational scientific basis. There cannot be pathogens on Mars because there are no plants or animals there for them to infect. As for free living microorganisms that might conceivably exist on Mars, we know that these cannot be a threat to the Earth’s biosphere because there has been natural transport of billions of tons of Martian materials to Earth for the past 4 billion years. In fact, it is estimated that every year, approximately 500 kilograms of rocks ejected from Mars via meteoric impact land on our planet. Close examination of these rocks has shown that large portions of them were never raised above 40 degrees Celsius during their entire career of ejection from Mars, flight

(Continued on Page 34)
Astrobotic officially opened its new headquarters in Pittsburgh in a ribbon-cutting ceremony on Monday. The 47,000 square foot complex is the largest private facility in the world dedicated to lunar logistics. Astrobotic’s Peregrine and Griffin lunar landers will be built on-site, with Peregrine set to become the first commercial mission to the Moon, and the first American lander on the Moon since the Apollo missions.

“I like to say we’re a 13-year overnight success story,” said Astrobotic CEO John Thornton. “In the past 18 months, we grew from a staff of 18 to more than 100 employees, with two funded lander missions and a rover mission to the Moon, and multiple contracts to develop exciting new space technologies. It’s still surreal.”

Monday’s ribbon-cutting ceremony was attended by a wide range of prominent federal, state, and local officials, including U.S. Secretary of Commerce Wilbur Ross, U.S. Congressman Conor Lamb, Pennsylvania Governor’s Action Team SW Director Eric Bitar, Allegheny County Executive Rich Fitzgerald, and Pittsburgh Mayor Bill Peduto. They were joined by local business and community leaders LaShawn Burton Faulk, Executive Director of Manchester Citizens Corporation, Sam Reiman, Director of the Richard King Mellon Foundation, and David Malone, Chairman and CEO of Gateway Financial.

“You [Astrobotic] are currently leading the market with seventeen contracts in place for your first mission with customers in seven countries,” says US Secretary of Commerce Wilbur Ross. “The Commerce Department will continue to make resources available to you and to the broader U.S. commercial space industry to ensure that we remain the leader in space commerce.”

“I personally want to thank all the folks at Astrobotic for taking on this national mission. You are a big part of our strategy going forward to be a successful, strong, growing economy in a country that is well-defended and well-represented in space. So thank you very much, we’re proud of you,” says U.S. Congressman Conor Lamb.

Astrobotic’s headquarters houses offices, labs, and fabrication areas, including a “clean room” and “high bay” required for final spacecraft assembly. Astrobotic will use the facility to build its lines of landers, rovers, autonomous spacecraft navigation systems, and other space technologies. The facility will also be used to operate them. When Peregrine lands on the Moon next year, it will be controlled directly from the Astrobotic Mission Control Center inside the Pittsburgh headquarters.

Phase two of the headquarters’ construction, now underway, will add a rover test pit, a drone flying arena, a public gathering space, additional offices, labs, and fabrication spaces.

The opening of the headquarters marks a major milestone in the company’s history. After its inception as a private company spinoff from Carnegie Mellon University’s Robotics Institute, Astrobotic started in a 400 square foot room above a bagel shop in Pittsburgh’s Oakland neighborhood. It later moved to a former steel-stamping factory in the Strip District, and then an office building downtown. The company has grown rapidly, signing fifteen commercial customers representing seven countries for its lunar payload delivery service, and winning a $79.5 million NASA contract to fly scientific instruments aboard Peregrine, and again in June by winning a $199.5 million contract to deliver NASA’s water-hunting rover, VIPER, to the south pole of the Moon.

“The first Astrobotic mission, which will fly on Peregrine, will deliver about a dozen NASA-developed payloads to a mid-latitude region on the Moon. These NASA-developed payloads will range in capabilities from technologies to demonstrations, demonstrate

(Continued on Page 37)
What the Pandemic Has Taught Us About Science

The scientific method remains the best way to solve many problems, but bias, overconfidence and politics can sometimes lead scientists astray (https://www.wsj.com/articles/what-the-pandemic-has-taught-us-about-science-11602255638) by Matt Ridley, (Mr. Ridley is a member of the House of Lords and the author, most recently, of “How Innovation Works: And Why It Flourishes in Freedom.”) (9 October, 2020) (with Permission)

The Covid-19 pandemic has stretched the bond between the public and the scientific profession as never before. Scientists have been revealed to be neither omniscient demigods whose opinions automatically outweigh all political disagreement, nor unscrupulous fraudsters pursuing a political agenda under a cloak of impartiality. Somewhere between the two lies the truth: Science is a flawed and all too human affair, but it can generate timeless truths, and reliable practical guidance, in a way that other approaches cannot.

In a lecture at Cornell University in 1964, the physicist Richard Feynman defined the scientific method. First, you guess, he said, to a ripple of laughter. Then you compute the consequences of your guess. Then you compare those consequences with the evidence from observations or experiments. “If [your guess] disagrees with experiment, it’s wrong. In that simple statement is the key to science. It does not make a difference how beautiful the guess is, how smart you are, who made the guess or what his name is…it’s wrong.”

So when people started falling ill last winter with a respiratory illness, some scientists guessed that a novel coronavirus was responsible. The evidence proved them right. Some guessed it had come from an animal sold in the Wuhan wildlife market. The evidence proved them wrong. Some guessed vaccines could be developed that would prevent infection. The jury is still out.

Seeing science as a game of guess-and-test clarifies what has been happening these past months. Science is not about pronouncing with certainty on the known facts of the world; it is about exploring the unknown by testing guesses, some of which prove wrong.

Bad practice can corrupt all stages of the process. Some scientists fall so in love with their guesses that they fail to test them against evidence. They just compute the consequences and stop there. Mathematical models are elaborate, formal guesses, and there has been a disturbing tendency in recent years to describe their output with words like data, result or outcome. They are nothing of the sort.

An epidemiological model developed last March at Imperial College London was treated by politicians as hard evidence that without lockdowns, the pandemic could kill 2.2 million Americans, 510,000 Britons and 96,000 Swedes. The Swedes tested the model against the real world and found it wanting: They decided to forgo a lockdown, and fewer than 6,000 have died there.

In general, science is much better at telling you about the past and the present than the future.

In general, science is much better at telling you about the past and the present than the future. As Philip Tetlock of the University of Pennsylvania and others have shown, forecasting economic, meteorological or epidemiological events more than a short time ahead continues to prove frustratingly hard, and experts are sometimes worse at it than amateurs, because they overemphasize their pet causal theories.

A second mistake is to gather flawed data. On May 22, the respected medical journals the Lancet and the New England Journal of Medicine published a study based on the medical records of 96,000 patients from 671 hospitals around the world that appeared to disprove the guess that the drug hydroxychloroquine could cure Covid-19. The study caused the World Health Organization to halt trials of the drug.

It then emerged, however, that the database came from Surgisphere, a small company with little track record, few employees and no independent scientific board. When challenged, Surgisphere failed to produce the raw data. The papers were retracted with abject apologies from the journals. Nor has hydroxychloroquine since been proven to work. Uncertainty about it persists.

A third problem is that data can be trustworthy but inadequate. Evidence-based medicine teaches doctors to fully trust only science based on the gold standard of randomized controlled trials. But there have been no randomized controlled trials on the wearing of masks.

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NASA’s OSIRIS-REx Spacecraft Successfully Touches Asteroid


NASA’s Origins, Spectral Interpretation, Resource Identification, Security, Regolith Explorer (OSIRIS-REx) spacecraft unfurled its robotic arm Tuesday, and in a first for the agency, briefly touched an asteroid to collect dust and pebbles from the surface for delivery to Earth in 2023. This well-preserved, ancient asteroid, known as Bennu, is currently more than 200 million miles (321 million kilometers) from Earth. Bennu offers scientists a window into the early solar system as it was first taking shape billions of years ago and flinging ingredients that could have helped seed life on Earth. If Tuesday’s sample collection event, known as “Touch-And-Go” (TAG), provided enough of a sample, mission teams will command the spacecraft to begin stowing the precious primordial cargo to begin its journey back to Earth in March 2021. Otherwise, they will prepare for another attempt in January.

“Touch-And-Go” provided nearly a minute of robotic arm contact with Bennu’s surface to stir up dust and pebbles. The gas was directed from the spacecraft toward the surface to allow the TAGSAM head to collect the dust and pebbles. The spacecraft then fired its thrusters to move away from the asteroid. Bennu’s rotation at the time of contact. It then continued a treacherous, 11-minute coast past a boulder the size of a two-story building, nicknamed “Mount Doom,” to touch down in a clear spot in a crater on Bennu’s northern hemisphere. The size of a small parking lot, the site Nightingale site is one of the few relatively clear spots on this unexpectedly boulder-covered space rock.

“This was an incredible feat – and today we’ve advanced both science and engineering and our prospects for future missions to study these mysterious ancient storytellers of the solar system,” said Thomas Zurbuchen, associate administrator for NASA’s Science Mission Directorate at the agency’s headquarters in Washington. “A piece of primordial rock that has witnessed our solar system’s entire history may now be ready to come home for generations of scientific discovery, and we can’t wait to see what comes next.”

All spacecraft telemetry data indicates the TAG event executed as expected. However, it will take about a week for the OSIRIS-REx team to confirm how much sample the spacecraft collected.

Real-time data indicates the TAGSAM successfully contacted the surface and fired a burst of nitrogen gas. The gas should have stirred up dust and pebbles on Bennu’s surface, some of which should have been captured in the TAGSAM sample collection head. OSIRIS-REx engineers also confirmed that shortly after the spacecraft made contact with the surface, it fired its thrusters and safely backed away from Bennu.

“Today’s TAG maneuver was historic,” said Lori Glaze, Planetary Science Division director at NASA Headquarters in Washington. “The fact that we safely and successfully touched the surface of Bennu, in addition to all the other milestones this mission has already achieved, is a testament to the living spirit of exploration that continues to uncover the secrets of the solar system.”

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SAN ANTONIO -- Oct. 14, 2020 -- A Southwest Research Institute (SwRI) planetary scientist has been chosen to be among the first group to conduct NASA-funded science experiments while flying aboard a commercial spacecraft, the space agency announced today.

Dr. Alan Stern, planetary scientist and associate vice president of SwRI's Space Science and Engineering Division, will fly aboard the Virgin Galactic commercial spacecraft called "SpaceShipTwo" on a yet unscheduled suborbital mission from the Spaceport America launch site in New Mexico.

"This is the first selection of a private-sector researcher to fly with NASA funding on commercial vehicles," Stern said. He called the development a "potential sea change" in NASA-funded space research, opening the door to much more extensive experimentation in space by researchers. The NASA selection made today builds on SwRI's long history of work and internal research funding to capitalize on the new generation of commercial suborbital vehicles like SpaceShipTwo.

"Our commercial suborbital space flight program dates back almost a decade," said SwRI President and CEO Adam L. Hamilton, P.E. "To see the results of SwRI's internal research efforts lead to historic SwRI-tended suborbital experiments is very exciting!"

In 2020, NASA updated the Flight Opportunities Tech Flights solicitation in part to allow "human-tended" experiments on board commercial spacecraft.

"We are proud to be working with NASA and the Southwest Research Institute to fly Dr. Alan Stern on our SpaceShipTwo vehicle from Spaceport America," said Michael Colglazier, Chief Executive Officer of Virgin Galactic. "It will be Alan's first time flying to space and we are excited to be involved in such an important milestone. Human-tended research onboard SpaceShipTwo enables scientists to engage actively with their experiments, responding to developments in real time, which is a vital step towards expanding our understanding of space science. We believe there is significant value in conducting scientific experiments on suborbital flights and we look forward to expanding our capabilities in partnership with NASA's Flight Opportunities Tech Flights program."

One SwRI experiment on the just announced flight will involve Stern operating a former space shuttle and NASA F-18 low light level camera to determine how well space astronomical observations can be conducted. Specifically, Stern will point the camera through a number of the spacecraft's windows. In addition, Stern will be fitted with instrumentation that continuously monitors human vital signs from just before the two-hour flight until after its landing as a biomedical experiment. The results of both experiments will be published.

"Going to work in space myself for the first time after having spent so many years sending machines there to do the research for me is going to be a major career highlight, and something I am honored to be selected for," said Stern, who has previously been involved in 29 space mission science teams but had not flown in space. "But I hope this is just the first of a steady stream of flights by SwRI researchers doing work in space in the years and decades ahead."

About Dr. Alan Stern:

Dr. Alan Stern's bio can be found here:

https://www.swri.org/sites/default/files/alan-stern-bio-brief.pdf
TAPASWINI SHARMA: Mars is My Ikigai (Award Winning Essays)

by Diamonds Mirror (with Permission) https://www.diamondsmirror.com/home/2020/tapaswini-sharma-award-winning

Tapaswini Sharma prepares to work in space and set foot on another celestial body in the decades. (Portrait Credits by DIAMONDS MIRROR Artist Reza Jozani)

Diamonds Mirror is pleased to publish Tapaswini Sharma in the Award Winning Essays category. At the age of 16, Tapaswini won the 2017 NASA Ames Space Settlement Design Contest Honorable Mention Award within the Individual selection after creating the Kirithra Orbis, a space settlement which in the next decades will reach to advance our civilization's mission and urban design in the solar system. Inspired by a honeycomb, the biosphere will become a second habitat to space explorers, expand into research laboratories and allow for other unique features that wouldn't normally take shape on Earth. During the 2020 Humans to Mars Summit, Tapaswini who is also a Janet's Planet Astronaut Academy student, gave an inspiring speech in response to this year's Mars Persevere theme. She ignited a new generation to take on the space education and exploration challenge. As the 2033 launch to the Moon and Mars becomes more serious by the second, our eyes unlike any time in history are beginning to look up toward the limitless universe and on to the many space technological possibilities already set in motion and full force in our daily lives. Tapaswini Sharma is celebrated as a young genius in her native country of India and more. Our Diamond recognition furthers our mission, to uncover unique, modern and open-minded Diamond characters like Tapaswini - who make us proud to follow in their footsteps, on planet Earth or Mars.

Congratulations Tapaswini Sharma!

The Importance of Space Education and Exploration

“I am Tapaswini Sharma from India and I will be talking about the importance of Space Education and Exploration. Before beginning, I would like to thank Ms. Janet Ivey and Explore Mars for giving me this incredible opportunity. I am honoured to be a part of the Humans to Mars Summit, 2020.

If you looked into the mind of a 14 year old me you would see stars floating around, people traveling to nearby planets for a weekend getaway and the Star Wars remake an actual space! Guess what? This is still a dream of mine, but now I want to make this dream a reality and join the amazing teams of superheroes around the globe who worked hard to send humans to space. I want to know more about Europa's Icy Crust, Saturn's moons and even the perchlorates on Mars. I have had the freedom of creative imagination thanks to space education. I believe space education has the power to influence lives for the better. It sparks curiosity and inspires human beings to pursue science. It integrates creative imagination and encourages them to dream big. My journey with space education started when I designed my first space settlement and met Ms. Janet Ivey back in 2015. Ever since then I have been astonished at how important space education is when it comes to development.

I encourage everyone out there to pursue STEM, which is Science and Technology, Engineering and Mathematics. I have always been curious about the things around me. When I was in first grade, I would make a parachute out of a plastic bag and some thread. I would throw it down from the second floor and count the number of seconds it took to reach the ground. As a child, I have always asked a lot of questions. Why is the sky blue? Why don't we fall off the earth? Why can't I

(Continued on Page 44)
Boeing to develop new payloads, capabilities, and missions for Orca large long-range unmanned submarines

The Echo Voyager has a range of 6,500 nautical miles on one fuel module, can reach depths of 11,000 feet, and can operate independently for months.

by John Keller, on 15 October, 2020 (with permission)
https://www.militaryaerospace.com/unmanned/article/14185349/unmanned-payloads-submarines

WASHINGTON – Undersea warfare experts at the Boeing Co. will develop new capabilities, payloads, and applications for the Orca Extra-Large Unmanned Undersea Vehicle (XLUUV) under terms of an $11.1 million order announced late last month.

 Officials of the U.S. Naval Sea Systems Command in Washington announced are asking the Boeing Defense, Space & Security segment in Huntington Beach, Calif., for engineering services to expand the XLUUV’s role in future naval operations.

The modular-construction Boeing Orca XLUUV is to be an open-architecture reconfigurable unmanned underwater vehicle (UUV) with the core vehicle providing guidance and control, navigation, autonomy, situational awareness, core communications, power distribution, energy and power, propulsion and maneuvering, and mission sensors, Navy officials say.

Boeing won a $43 million Navy contract in early 2019 to build four XLUUVs, which are autonomous mini-submarines based on the Boeing-designed Echo Voyager large UUV. Echo Voyager’s advanced autonomy enables it to operate in clear and congested waters without physical human contact.

Related: Northrop Grumman to integrate weapons and sensors payload delivery system for large unmanned submarines

The Echo Voyager has a range of 6,500 nautical miles on one fuel module, can reach depths of 11,000 feet, and can operate independently for months underwater. It is 51 feet long, with a modular payload section as long as 34 feet and a volume of 2,000 cubic feet. Boeing unveiled the Echo Voyager in early 2016 and began sea trials of the unmanned undersea craft in summer 2017.

The large UUV’s navigation system uses a Kalman-filtered inertial navigation unit supported by Doppler velocity logs and depth sensors. Powering the vessel is a hybrid combination of batteries and marine diesel generators. It can launch from shore or from large military ships with well decks, or from large civil vessels with moon pools.

The Lockheed Martin Rotary and Mission Systems segment in Riviera Beach, Fla., also has been involved in designing prototype XLUUV systems.

The Boeing Orca XLUUV will have well-defined interfaces for future upgrades to capitalize on advances in technology and respond to threat changes. The Orca XLUUV will have a modular payload bay, with defined interfaces to support current and future UUV payloads.

[XLUUVs, which are among the largest unmanned submersibles ever conceived, will be for long-endurance surveillance missions or undersea cargo vessels to deliver other sensor payloads and other UUVs.

These large unmanned undersea vehicles eventually could be used as motherships to deploy and recover smaller surveillance UUVs on far-flung reconnaissance, surveillance, or special warfare missions in the open ocean or along coastlines and inside harbors.

The Navy's XLUUV project is moving enabling technologies forward that were developed originally in other projects such as the DARPA Hydra program to develop an unmanned submersible large enough to transport and deploy UAVs and UUVs stealthily in enemy territory to respond quickly to situations around the world.

On this order Boeing will do the work in Huntington Beach, Calif.; and Cockeysville, Md., and should be finished by September 2021. For more information contact Boeing Defense, Space & Security online at www.boeing.com/company/about-bds, or Naval Sea Systems Command at www.navsea.navy.mil.
2020 NASA Tipping Point Selections
https://www.nasa.gov/directorates/spacetech/solicitations/tipping_points/2020_selections

The following selections, organized by topic area, are based on NASA’s fifth competitive Tipping Point solicitation and have an expected combined award value of more than $370 million. NASA’s Space Technology Mission Directorate (STMD) will negotiate with the companies to issue milestone-based firm-fixed price contracts lasting for up to five years.

Cryogenic Fluid Management Technology Demonstration

NASA and industry partners have developed and tested numerous technologies to enable long-term cryogenic fluid management, which is essential for establishing a sustainable presence on the Moon and enabling crewed missions to Mars. Implementation of the technologies in operational missions requires further maturation through in-space demonstrations.

• Eta Space of Merritt Island, Florida, $27 million
Small-scale flight demonstration of a complete cryogenic oxygen fluid management system. As proposed, the system will be the primary payload on a Rocket Lab Photon satellite and collect critical cryogenic fluid management data in orbit for nine months. The small business will collaborate with NASA’s Marshall Space Flight Center in Huntsville, Alabama, NASA’s Glenn Research Center in Cleveland, and NASA’s Kennedy Space Center in Florida.

• Lockheed Martin of Littleton, Colorado, $89.7 million
In-space demonstration mission using liquid hydrogen – the most challenging of the cryogenic propellants – to test more than a dozen cryogenic fluid management technologies, positioning them for infusion into future space systems. Lockheed Martin will collaborate with Marshall and Glenn.

• SpaceX of Hawthorne, California, $53.2 million
Large-scale flight demonstration to transfer 10 metric tons of cryogenic propellant, specifically liquid oxygen, between tanks on a Starship vehicle. SpaceX will collaborate with Glenn and Marshall.

• United Launch Alliance (ULA) of Centennial, Colorado, $86.2 million
Demonstration of a smart propulsion cryogenic system, using liquid oxygen and hydrogen, on a Vulcan Centaur upper stage. The system will test precise tank pressure control, tank-to-tank transfer, and multi-week propellant storage. ULA will collaborate with Marshall, Kennedy, and Glenn.

Lunar Surface Innovation Initiative Technology Demonstration

As part of NASA’s Lunar Surface Innovation Initiative, the agency invests in technologies needed to advance in-situ resource utilization, surface power generation and energy storage, communications, and more. These capabilities will help humans and robots explore more of the Moon.

• Alpha Space Test and Research Alliance of Houston, $22.1 million
The space science and technology evaluation facility will give small experiments access to the lunar environment to collect data and experience exposure to the ultraviolet and charged particle radiation.

• Astrobotic Technology of Pittsburgh, $5.8 million
Mature and demonstrate a fast, wireless charging system that addresses challenges associated with using the technology on the Moon. The effort will build and deliver flight units for potential use on commercial robotic landers. Astrobotic will collaborate with Glenn.

• Intuitive Machines of Houston, $41.6 million
Develop a small, deployable hopper lander capable of carrying a 2.2-pound (1-kilogram) payload more than 1.5 miles (2.5 kilometers). This hopper could access lunar craters and enable high-resolution surveying of the lunar surface over a short distance.

(Continued on Page 45)
The Phantom and the Elephant
by Conelius Neil Cosentino, (Chapter 1, Letters from the Cockpit) (with Permission)

City of Hue, South Vietnam, 1972

My first combat mission in the F-4E Phantom took place in late summer of 1972. It was a few months before the 366th Tactical Fighter Wing "The Gunfighters" deactivated at Takhli Royal Thai Air Base, Thailand and my squadron, the 4fg, moved a few hundred miles up the road to Udorn Royal Thai Air Base. This was my third combat tour, but my first tour in a fighter. I am not a war lover, but it was worth the long wait, a tour that most pilots can only dream about. Every mission was different, whether day or night, in clear or marginal weather; a different county - North Vietnam, Laos or South Vietnam, a different type mission and a different type of ordnance.

It would be the first time in my military career that I would be authorized by war orders to drop bombs that would destroy enemy forces. This enemy started the killing and they learned over the preceding seven years how to shoot back with some success. The best part of my combat tour was the grand finale. I flew many of the combat missions during our proudest moment of the war, Linebacker II; the eleven nights of air war over the Red River Valley from December, 1972 to January, 1973. The Linebacker II missions not only drove the North Vietnamese to the peace table; it also brought home American prisoners of war, and proved once and for all that Air Power is the decisive weapon in any conflict. It was Kissinger who gave North Vietnam the win at the Peace table.

I had paid my dues for this tour by staying in Strategic Air Command (SAC) during the mid-sixties instead of going with the airlines. An important personal gamble that paid off after the SAC tours in bombers and tankers and two combat tours in other aircraft, including one as an airborne battle staff officer in a EC-130. I finally got into a Phantom; the world's greatest fighter aircraft, the aircraft that I flew in some of the best combat missions of the entire war in Southeast Asia.

The "frag", or fragmentary order of the war plan, the legal instrument that authorized the use of deadly force and those to be killed, called for a low risk, almost introductory supply road cut mission. The target was located on a road in a low threat area of southern Laos. My Phantom 68-326 was loaded with twelve 500 pound Mark 82 "slicks" fused for road cuts. What a magnificent warhorse that aircraft still is. I believe that the F4-E and later model Phantoms with new engines and new electronics would still be one of the best all-around air weapons system ever made by man. And to this day I have never met or known of a fighter pilot who has done all the things the Phantom is capable of doing. And I suspect that even today our pilots are never asked to reach that goal.

The Wing policy was that the squadron operations officer (OPS) had to fly back seat with all the new pilots on their first combat mission. And as his luck would have it, my first mission was diverted by "Hillsboro" Orbit" (the airborne EC-130 command post) just after we crossed the Mekong river into Laos. We turned port to the northeast, toward Mugia Pass and crossed the mountains into Vietnam. Our new mission was a close air support (CAS) for a hot troops in Contact (TIC) mission in the city of Hue near the demilitarized zone (DMZ), where our troops were engaged in heavy street fighting. This was to have been a first mission milk run, an obscure routine road cut in southern Laos to prove to the squadron OPS officer that I could hit the ground with my bombs and find my way home. But this mission became something much more vital, it was now a troops in contact (TIC) in the middle of the city of Hue, near the DMZ.

It was his luck of the draw to be with me, the new guy on a TIC for his first combat mission; flying the back seat with a pilot who had never seen combat, had never "Seen the Elephant". We met only a week ago and now we were circling the center of Hue with a part of his future riding on where my bombs fell.

There are no really worthwhile personal rewards for killing an unseen enemy in this kind of a war. The very best that can be said is that it is a job that has to be done; hopefully it will be done professionally, with the appropriate level of human detachment. But it was fair in a way. Ho Chi Min started the shooting, the killing. If you shot at them and they could, and did, shoot back. On the other hand, there is a terrible price to pay for killing the innocent, especially the good guys, with friendly fire. There was little or no worthwhile reward for the meaningless day-to-day risks everyone took in that war, (Continued on Page 46)
At the EAST ENTRANCE to the Western Museum of Flight outdoor display area in the Torrance airport. Northrop engineering test pilot, Roy Martin, conducting a masked and guided visit to the YF-23 and other aircraft that are on display in a fenced display area.

Roy Martin (right) showing a NASA experimental aircraft (Tommy Thompson on the left)

Mr. Jerry Lockenour joining the session on Zoom.
National Chemistry Week (19-24 October, 2020) (Screenshots Only)

Prof. Ian Haworth (USC) opening the National Chemistry Week with SCALACS and AIAA LA-LV with a talk on Drug Design and Delivery to show how Chemistry is fun and beneficial to daily life.

"How to leverage your life experience into starting a business"

Marty Waldman - Las Vegas AIAA Chair
https://www.linkedin.com/in/marty-waldman-6688368

(Left) Mr. Marty Waldman (SIL) sharing his experiences on starting a business as an alternative career path; (Right) Professor G. K. Surya Prakash (USC) sharing his excitement and the award from the Israel Prime Minister in 2013 for his Chemistry work.

(Left) Panel discussion on Women in STEM fields; (Right) Panel discussion on Young Professional and STEM K-12 Education.
AIAA LA-LV Young Professional (YP) Meeting (26 October, 2020)
Technology Transfer, SBIRs, and Non-Dilutive Funding Sources (Screenshots Only)

The Licensing Process
1. Find an interesting technology (with commercial potential) in a field that you are familiar with
2. Contact technology transfer office
3. Contract negotiation
4. Commercialization efforts
5. Revisit benchmarks and goals
6. Further research

Mr. Brett Cornick (AIAA LA-LV YP Chair explaining the SBIR contract licensing process basics to the young professionals.

SBIR/STTR Basics
- Small Business Innovation Research (SBIR)
  3.2% of extramural research budget for agencies with budget > $100 M/yr.
  ~$3.2 billion min. spend each year

- Small Business Technology Transfer (STTR)
  0.45% of extramural research budget for agencies with budget > $1B/yr.
  ~$450 million min. spend each year

Phase I
- Concept Development
- 6 months – 1 year
- < $500,000
- 16% Success Rate

Phase II
- Prototype Development
- 24 months
- < $750K – $1.7M
- 50% Success Rate

Phase III
- Commercialization
- No SBIR funding

> 5,000 new awards yearly

Dr. Dennis Wonica (AIAA Enterprise Chair) presenting the SBIR/STTR basics to the young professionals.

What is Technology Transfer?
- Transfer of knowledge, data, or intellectual property from a university or agency to the public
- Usually done through formal licensing
- Many steps to the process, but entrepreneurs are mostly concerned with the license negotiation and commercialization steps
- Most research universities and government agencies (DoD, DoE, NASA, etc.) have some sort of tech transfer program
- Anyone can license a technology, but it is up to the inventor and owner of the IP to decide who they want to license to
- Most common licensee is small businesses

Q&A and Technology Transfer discussions with Mr. Brett Cornick and Dr. Dennis Wonica with the young professionals.
(October 29, 2020) e-Happy Hour with AIAA LA-LV, featuring André Bormanis and Science, Sci-Fi, Media (Screenshot Only)

Some of the attendees showing their faces and chatting casually in the e-Happy Hour.

Mr. André Bormanis (AIAA member) sharing his life, writing, Sci-Fi film production, and fun!

Ms. Paula Korn, writing a novel, sharing her views, and asking suggestions/recommendation from Mr. André Bormanis.
(October 31, 2020) AIAA LA-LV Celebrates the 20th Anniversary of the International Space Station (Screenshot Only)

Mr. Larry Trager (Aerojet-Rocketdyne) leading the panel on the ISS 20th Anniversary History & Perspective discussion with some attendees.

Dr. Cheng-Yi Lu (Aerojet-Rocketdyne) explaining the ISS power system, and the future Artemis Lunar and Mars Missions

(Left) Mr. Liam Kennedy demoing the ISS-Above Gizmo he invented and (Right) showing the live sunrise view from ISS in real-time during the event, sharing the excitement and direct experience with ISS during the ISS 20th Anniversary with AIAA LA-LV! Really Fun and Inspiring!
Mr. Fosse Lin-Bianco opening the event and showing the raffle prizes.

Mr. Alan Chan demoing the Mars Driving Simulator Software and sharing the fun with the K-12 students and educators.

Mr. Fred Lawler and Mr. Fosse Lin-Bianco led the discussions.
AIAA LA-LV e-Town Hall Meeting (7 November, 2020) (Screenshots Only)
Part I: Perlan Project Glider Soars into History by Jim Payne
Part II: Time-Sensitive Air Refueling Mission by Lt. Col. Mark Hasara

Mr. Jim Payne explaining the principles of soaring and the Perlan glider project, also sharing the fun and excitement of engineering, aviation, and record-breaking!

Mr. Jerry Lockenour sharing his personal stories and interactions with the founder of the Perlan Project, Einar Enevoldson, who was one of the 2 primary NASA RPRV test pilots when Jerry was at NASA Dryden (now Armstrong). When Einar retired from NASA he personally (in Perlan 1) broke the glider alt. record. While still at NASA he had seen some atmospheric data that indicated to him that there were some unique high altitude phenomenon that could be explored for soaring. And by the way they form Pearlescent Clouds....thus the project name of Perlan. Einar then discovered that the most powerful location on the planet for this condition is in the Southern Hemisphere in Patagonia. The condition is created a couple times a year (in the Southern Winter) when the southern polar vortex (a high alt. wind pattern) comes up over the tip of the Andes Mountains. The Perlan project has made many trip to Patagonia over the few years. After 1st breaking the record with a modified existing glider Einar designed a new glider from scratch (the Perlan 2) with a pressurized cockpit and a very unique wing airfoil for the extreme altitude. The Perlan 2 is the one that they have now take to 76,124 ft and are still trying to get to maybe 90,000 ft.

AIAA LA-LV e-Town Hall Meeting (14 November, 2020) (Screenshots Only)
Part I: 43rd Anniversary of the Voyagers 1 & 2: Humanity’s Most Distant Explorers with Special Notes on Uranus and Neptune by Todd Barber (NASA JPL)
Part II: Modeling and Simulation Best Practices to Help Fight COVID-19 by Dr. Swati Saxena (ANSYS)
Part III: Best Taiwan Defense Strategy by Dr. Stephen Bryen (Former Deputy Undersecretary of Defense)

Mr. Todd Barber (AIAA Distinguished Lecturer), reviewing the great excitement and discoveries by the Voyager I & 2 Missions.

Dr. Swati Saxena explaining the airplane cabin airflow / COVID-19 virus spread simulation using ANSYS Tools.

Dr. Stephen Bryen explaining the military situations facing potential invasion and the threats from China.
AIAA LA-LV Young Professional (YP) Meeting (17 November, 2020)

Team Building and Consultant Resources *(Screenshots Only)*

https://aiaa-lalv.org/november-17-2020-young-professionals-meeting-team-building-and-consultant-resources/

Mr. Brett Cornick (AIAA LA-LV YP Chair) opening the meeting and showing the agenda.

Mr. Daniel Connor sharing his experiences especially in the drone business and the transition from the military to the civilian career.

Mr. Craig Tomita explaining the CMTC functions and resource for manufacturers (even just 1 person) and sharing his experience from the automation / robotics business.
What would a China-US war look like?
The most likely trigger for a conflict between the nuclear-armed rivals would be an invasion of Taiwan
by Stephen Bryen and Shoshana Bryen, 21 October, 2020 (with Permission)

Most US-sponsored war games focus on a possible American response to a Chinese invasion of Taiwan. They also dwell on “worst-case” outcomes. The Rand Corporation, for example, wrote its scenario in the context of NATO already fighting in Eastern Europe when China launches an assault on Taiwan. And while some US war games focus on strategic outcomes, most look at tactical issues (airpower to airpower or “local” warfighting), not a full-blown war between China and the US. And while there are both historical and tactical reasons to think that China might test its prowess against lesser, but still highly important, objectives, none consider scenarios other than a direct invasion of Taiwan. China’s superior numbers of missiles, its air defenses, and its alleged dominance, also are presumed in the US wargame planning.

Some of those and other underlying assumptions may be outdated and may understate American strengths.

While China may have had hopes in the past that the US would ignore Chinese aggression against Taiwan, America’s dislike for China is at an all-time high and the chance that any administration could simply sit on its hands appears remote. By invading Taiwan, China would be taking a massive – perhaps fatal – risk of engaging the US in a big war.

If the US did intervene, most military experts and analysts agree that a major American effort would include stealth bombers and F-35 aircraft playing a key role in destroying Chinese air defenses, missiles and air bases. While China has the S-400 air defense system (but not its long-range interceptor missiles, which the Russians promised but didn’t deliver), it is unlikely to accurately detect stealth aircraft. The S-400 fire control and tracking radar is the 92N6E “Grave Stone” – a good radar somewhat like the one used by Patriot. There is speculation that the S-400 could exploit weaknesses in the F-35, but this is unproven and unlikely, in our opinion. Moreover, the formidable F-22 stealth fighter bomber and B-2 strategic bomber, can kill the S-400 fairly easily. American F-35s, meanwhile, can take out Chinese fighter and bomber aircraft, including the J-20 Chinese stealth plane. India has already discovered that the J-20 is easily picked up even on older Russian radars.

The US has moved very far ahead of all potential competitors in the integration of its fighting systems, taking advantage of networking and the automatic allocation of targets, optimizing war fighting and force multiplying air, sea, and land platforms. Whether China has any ability along these lines isn’t known, but China has not had any combat experience for years and its fast tracking of military hardware production (often based on knock-offs of Russians and US equipment) suggests that most of these systems are discrete and not functionally integrated or optimized. While there are reasons to be concerned with some systems, such as the DF-17 and the DF-21D, we do not believe that China has enough of these missiles to change the outcome of a major confrontation.

As such, it is highly likely China’s military prowess has been seriously overrated by Pentagon war gamers. That raises the concomitant risk that the Chinese might come to believe the American overestimates of China’s capabilities.

But even if China’s leaders are “drinking their own beer” and ours with it, would Beijing want to risk a war with the United States by invading Taiwan? The US has been through wars before, including the Korean war, where despite massive setbacks (even serious consideration by American generals to use atomic weapons), the US and its allies pushed so-called Chinese “volunteers” and their Russian friends back to the current armistice line.

(Continued on Page 48)
Astrobotic & University of Pittsburgh’s SHREC Partnering for Space Technologies Research

Teams will work together to translate concepts into tangible innovations that will support lunar landings, rover missions, satellite servicing, and more

by Astrobotic Technology, Inc., on 6 November, 2020 (with Permission)

Astrobotic and the National Science Foundation (NSF) Center for Space, High-performance, and Resilient Computing (SHREC) are pleased to announce a partnership to develop new software and hardware technologies for future space applications.

The SHREC consortium, led by the University of Pittsburgh, is an NSF Industry-University Cooperative Research Center (IUCRC) and will work together with Astrobotic by pairing first-class academic researchers with engineering teams to translate concepts into tangible innovations that will support lunar landings, rover missions, satellite servicing, and more. A diverse cohort of researchers, scientists, and engineers at Astrobotic and SHREC will share intellectual property, domain expertise, and practical know-how to develop space computing platforms, among other technologies.

The teams have already kicked off collaboration on Astrobotic’s Phase II NASA SBIR contract to develop UltraNav, a compact smart camera for next-generation space missions. This low size, weight, and power system includes an integrated suite of hardware-accelerated computer vision algorithms that enable a wide range of in-space applications, including satellite servicing, autonomous rover navigation, and precision planetary landing.

“The University of Pittsburgh’s space-focused engineering program is developing incredible technologies through a mixture of universities and companies supporting foundational and applied research,” says Chris Owens, Astrobotic Research Engineer and Principal Investigator for the UltraNav project. “In addition to research collaboration, Astrobotic is taking advantage of the partnership with SHREC to revamp our internship program. We are supporting not just SHREC students, but students in Pittsburgh and beyond who might want to give space a try.”

“On behalf of all students and faculty in SHREC, we are most honored to be partnering with the leading space company in our region,” said Alan George, SHREC Center Director and R&H Mickle Endowed Chair of Electrical and Computer Engineering at Pitt’s Swanson School of Engineering. “We look forward to many collaborations on space research, technologies, experiments, and workforce development.”

SHREC has a proven track record of developing computing solutions and advanced algorithms to handle the challenging radiation and thermal environment of space. Astrobotic has most recently worked with Bosch Research to develop hardware for the SoundSee Mission to the International Space Station (ISS). SHREC also boasts hardware currently in orbit on the ISS through multiple missions with the Department of Defense’s Space Test Program. SHREC and Astrobotic will use these platforms to test technologies in space before launching.

Astrobotic and SHREC, both founded in 2007, are examples of the Pittsburgh region’s renewed invigoration in the space industry – Astrobotic with its recent $199.5 million VIPER contract win from NASA and SHREC curating its dozens of partnerships with leading space companies and agencies across the nation. Both Astrobotic

(Continued on Page 49)
Ex-Pentagon official suggests leasing F-35 stealth jets to Taiwan

Aircraft could be stationed on standby outside Taiwan to thwart spies and preemptive strikes

by Matthew Strong, Taiwan News, Staff Writer, 9 October, 2020 (with Permission)


TAIPEI (Taiwan News) — In the face of aggressive incursions by China’s Air Force, the United States should help Taiwan by leasing it F-35 stealth jets, a retired Pentagon official wrote in Newsweek Thursday (Oct. 8).

Former Deputy Under Secretary of Defense Stephen Bryen said that Taiwanese pilots’ supposed lack of ability to fly the sophisticated fighters could be helped by training them in the United States. Any fears of China’s reaction could lead to the aircraft being kept on standby in the U.S., though they would either belong to Taiwan or be leased by the island.

Looking at its current fleet of jets, by the end of 2020, 50 of its 140 F-16 jets would be upgraded, but it still would have to wait at least five years for the delivery of 66 new F-16V versions, Bryen said. The lease of stealth fighters would also make more financial sense than the purchase of new jets or the upgrading of all old ones, he added.

In the event of a conflict, Taiwan’s airports would be the first target for a Chinese attack, thus favoring the F-35B, the world’s first supersonic short takeoff and vertical landing stealth jet, as it is “perfect for Taiwan and has sufficient range for the island’s protection,” given that some of them are already based in Japan, Bryen said.

Advantages of not having the jets in Taiwan from the start are that Chinese spies will not have access to training and exercises, while a preemptive attack by China will not be possible, his opinion piece for Newsweek concludes.
Will war start with Quemoy and Matsu?

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

https://www.americanthinker.com/blog/2020/10/will_war_start_with_quemoy_and_matsu.html (17 October, 2020)

No one is asking President Trump or Joe Biden what they think about Quemoy and Matsu, but people ought to, because the Chinese are gearing up to attack Quemoy, and maybe even go as far as trying to do damage to the Taiwan Air Force base on Penghu (the Pescadores Islands), which are all Taiwan-controlled islands.

We all remember that in 1960, in the presidential debates between Richard Nixon and John F. Kennedy, Kennedy took the position that Quemoy and Matsu were "indefensible" and that Taiwan should pull back from these islands. Nixon, however, said the U.S. should defend them. (Later, when polls showed that the American people sided with Nixon on this issue, Kennedy "revised" his opinion.)

Today, no one knows where either presidential candidate stands on this question. Unlike the run-up to 1960, the Chinese have not tried (as they did then) to attack Quemoy and Matsu. In 1949 and again in the 1950s, China twice tried invading Quemoy, and in 1958, China heavily and brutally shelled the island. (One result is that there is still today a thriving industry on Quemoy where artisans make fine chef's knives hewn from expended artillery shells).

Will the U.S. move to blunt an attack on Quemoy? Or wait and see? What are the consequences for Taiwan's independence from domination by Communist China?

China knows that the U.S., at least under President Trump, is likely to oppose any Chinese military action against Taiwan itself. But do the Chinese think the U.S. is wobbly when it comes to the outlying islands? Would President Xi seek to assert himself within China, and buttress his sagging support within the Communist Party establishment, by slamming PLA forces into Quemoy? Does he think he will get away with it?

Quemoy is the Portuguese name for Kinmen. I have been to Kinmen three times. The island is fortified with bunkers and underground systems. Even the island's main hospital is below ground and has massive blast doors. But there are only a small number of troops on the island and no fighter aircraft or modern air defenses. In Xiamen on mainland China, across from Kinmen, the PLA is practicing invading Taiwan, but this practice may be a ruse for the nearby objective of Kinmen.

Kinmen is 28.2 km from Xiamen, and even when taking into account that PLA forces will be spread around, none of them immediately needed would be more than 100 km from Kinmen. Taiwan would have to try to defend Kinmen either from Taiwan proper or from Penghu, where Taiwan keeps some of its home-built FCK-1 fighters. In the last weeks, Chinese war planes have threatened Penghu, Kinmen, and Taiwan proper. In fact, Taiwan's president, Tsai Ing-wen, visited the Penghu Magong Airbase on September 22 to congratulate the Taiwanese fighter pilots who, with only five minutes' warning, defended the island's airspace against Chinese fighter jets and bombers.

The population of Kinmen (consisting of two islands) is around 150,000. Penghu has a smaller population (it is actually an archipelago) of 102,000. Penghu is 154 km from Kinmen. Taiwan is roughly 277 km from Kinmen. While Taiwan can support Kinmen, it is likely to find the fighting difficult and painful. For sure, such an attack could destabilize Taiwan.

The wild card is the United States. If the United States rubs its hands and expresses sympathy but does nothing else, China wins. Taiwan's stability and future will be cast in serious doubt. This is what President Nixon was saying when he was a candidate in 1960 and why he supported fighting for Quemoy and Matsu. But by the time he became president, it is far from clear he kept the same opinion. After all, it was Kissinger and Nixon who derecognized Taiwan, pulled U.S. forces and closed U.S. bases on the island, and treated Taiwan as an outcast and lost cause. Congress intervened in 1979 with the Taiwan Relations Act to try to salvage the situation.

Congress does not have an Army, an Air Force, a Navy — neither can Congress perform the role of commander in chief. While Taiwan retains strong political support on Capitol Hill, the degree of support it has in the Great Power Game in Asia within the U.S. national security establishment is uncertain at best. All recent war games that tried to assess the U.S. position vis-à-vis a conflict over Taiwan have been negative for the U.S. winning such a fight. Any commander-in-chief will be deeply concerned about the outcome and the impact it would have on U.S. security interests in the Pacific.

But China also has to be worried that the U.S. would intervene and help Taiwan repulse any Chinese attack. That would throw off its barely hidden plan to launch an attack, perhaps trying to exploit the uncertainty associated with a U.S. election. In ideal circumstances, President Trump should make U.S. intentions clear: that America won't abandon Taiwan or let Kinmen or Penghu fall to the Chinese military. He can also ask Biden to join him in such a declaration to strengthen its impact even more.

(Editors note: 1960 Nixon – Kennedy Presidential Debate)

https://www.youtube.com/watch?v=jznAlySwkmM
(4:56 into the video about Quemoy and Matsu)
Limitless Space Institute announces inaugural Interstellar Initiative Grants awards by Limitless Space Institute, Inc. (with Permission)


HOUSTON, Sept. 1, 2020 /PRNewswire/ -- Limitless Space Institute is a non-profit organization whose mission is to inspire and educate the next generation to travel beyond our solar system and to research and develop enabling technologies. To that end, the single most important performance metric to enable bold human exploration of the outer solar system and the stars is the ability to GO INCREDIBLY FAST to any destination. This requires significant advances in performance characteristics of spacecraft power and propulsion systems. To support this bold objective, the Limitless Space Institute (LSI) initiated the Interstellar Initiatives Grants (I2G) to support the critical R&D of advanced power and propulsion approaches.

LSI has completed the proposal review process for this initial grant cycle and is selecting 9 proposals as the inaugural class of the I2G. These funded proposals will focus on topics such as maturing beamed energy propulsion, developing relativistic-capable solar sails, exploring new fusion propulsion approaches, conducting fundamental physics research on the vacuum that may enable spacedrives, and optimization of wormhole energy requirements and topology.

These awards are categorized as either tactical grants (≤$100k) or strategic grants (≤$250k), with the former focused on research papers and the latter on laboratory testing. The period of performance for the grants is expected to be 12 months in duration, with a start date by the end of September 2020. The selections are listed here with possible mission applications identified:

**Directed Energy for Revolutionary Space Propulsion and Power Projection (STRATEGIC):** Modular and scalable directed energy approach with propulsion applications ranging from rapid solar system missions to the first relativistic missions capable of robotic interstellar flight | Phil Lubin, University of California, Davis (Editor's note: It should be UC Santa Barbara)  
*BEAMED POWER; supports human exploration of outer solar system, interstellar

**Centrifugal Confinement Direct-Drive Fusion Propulsion (TACTICAL):** Uses axial loss cone alphas from centrifugally confined D-T fusion plasma to directly generate RF electrical power upstream and to heat bypass propellant flow downstream for variable thrust and high specific impulse | Ray Sedwick, University of Maryland  
*FUSION POWER/PROPULSION; rapid human exploration of outer solar system, interstellar

**Photonic Crystal Sail fabrication and test (STRATEGIC):** development and demonstration of scalable large-aspect-ratio photonic crystal nanoscale membranes with large-bandwidth high reflectivity, low optical absorption, and high strength | Richard Norte, Delft University of Technology, The Netherlands  
*SAIL; interstellar probe
NASA’s SpaceX Crew-1 Astronauts Headed to International Space Station
(15 November, 2020)

A SpaceX Falcon 9 rocket carrying the company’s Crew Dragon spacecraft is launched on NASA’s SpaceX Crew-1 mission to the International Space Station with NASA astronauts Mike Hopkins, Victor Glover, Shannon Walker, and Japan Aerospace Exploration Agency astronaut Soichi Noguchi onboard, Sunday, Nov. 15, 2020, at NASA’s Kennedy Space Center in Florida. NASA’s SpaceX Crew-1 mission is the first crew rotation mission of the SpaceX Crew Dragon spacecraft and Falcon 9 rocket to the International Space Station as part of the agency’s Commercial Crew Program. Hopkins, Glover, Walker, and Noguchi launched at 7:27 p.m. EST from Launch Complex 39A at the Kennedy Space Center to begin a six month mission onboard the orbital outpost.

Credits: NASA/Joel Kowsky

An international crew of astronauts is en route to the International Space Station following a successful launch on the first NASA-certified commercial human spacecraft system in history. NASA’s SpaceX Crew-1 mission lifted off at 7:27 p.m. EST Sunday from Launch Complex 39A at the agency’s Kennedy Space Center in Florida.

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The SpaceX Falcon 9 rocket propelled the Crew Dragon spacecraft with NASA astronauts Michael Hopkins, Victor Glover, and Shannon Walker, along with Soichi Noguchi of the Japan Aerospace Exploration Agency (JAXA), into orbit to begin a six-month science mission aboard the space station.

“NASA is delivering on its commitment to the American people and our international partners to provide safe, reliable, and cost-effective missions to the International Space Station using American private industry,” said NASA Administrator Jim Bridenstine. “This is an important mission for NASA, SpaceX and our partners at JAXA, and we look forward to watching this crew arrive at station to carry on our partnership for all of humanity.”

The Crew Dragon spacecraft, named Resilience, will dock autonomously to the forward port of the station’s Harmony module about 11 p.m. Monday, Nov. 16. NASA Television and the agency’s website are providing ongoing live coverage through docking, hatch opening, and the ceremony to welcome the crew aboard the orbiting laboratory.

"I could not be more proud of the work we've done here today,” said Gwynne Shotwell, president and chief operating officer of SpaceX. “Falcon 9 looked great, Dragon was dropped off into a beautiful orbit about 12 minutes into the mission, and we'll get more data as we go.”

The Crew-1 mission is the first of six crewed missions NASA and SpaceX will fly as part of the agency’s Commercial Crew Program. This mission has several firsts, including:

• The first flight of the NASA-certified commercial system designed for crew transportation, which moves the system from development into regular flights;
• The first international crew of four to launch on an American commercial spacecraft;
• The first time the space station’s long duration expedition crew size will increase from six to seven crew members, which will add to the crew time available for research; and
• The first time the Federal Aviation Administration has licensed a human orbital spaceflight launch.

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Astrobotic, WiBotic, Bosch, University of Washington, NASA GRC to develop Wireless Ultra-Fast Proximity Charging for Critical Space Applications

Astrobotic wins $5.7 million NASA Tipping Point contract to lead Bosch, WiBotic, the University of Washington, and the NASA Glenn Research Center (GRC) in developing a product line of lightweight proximity chargers. These ultrafast wireless chargers will enable critical lunar applications for both humans and robots.

Though prototypes for wireless charging have existed since 2011, this magnetic resonance-based power supply system is the first of its kind in space proximity charging. Comprised of a base station and power receiver, the system will be space-qualified and will eliminate common problems like planetary regolith (dust) interfering with mechanical charging connections.

“Generating, storing, and transmitting power is a critical infrastructure needed for all human and robotic activities in space,” says Cedric Corpa de la Fuente, Electrical Engineer for Planetary Mobility at Astrobotic. “Solar powered systems require continuous access to the Sun. A wireless charging system would mitigate challenges for standalone systems that don’t have the resources to generate power independently through the traditional methods.”

Astrobotic’s scalable, ultralight CubeRover – developed in collaboration with the NASA Kennedy Space Center – is the first space technology that will be integrated with the wireless charging system. Part of NASA’s Tipping Point contract will fund development of CubeRover’s intelligent autonomous navigation system, enabling highly precise navigation where GPS is not an option. This equips the CubeRover – and other planetary roving technologies – to find charging docks to power-up again and again, surviving the 14-day lunar night.

“These rovers need easy and reliable access to power in an environment that includes extremely abrasive dust and severe temperatures, making this a perfect application for WiBotic’s innovative non-contact proximity charging solutions,” says Dr. Ben Waters, CEO of Wibotic. “We’re looking forward to working with Astrobotic and the team to deliver flexible and durable charging stations that provide power to a range of manned and unmanned lunar vehicles.”

“All aspects of wireless communication, sensing, localization and charging, have to work optimally along with multi-sensor fusion to provide a robust solution,” said Dr. Vivek Jain, head of the Wireless Connectivity and Sensing group at Bosch Research in Silicon Valley.

Astrobotic will space qualify the entire system, test engineering and flight models, and lead integration of the CubeRover and WiBotic’s ultra-fast wireless charging system. Along with developing the software API, WiBotic will provide engineering, mechanical, and electrical design support. Bosch will engineer “smart” charge docking software for CubeRover, prototype materials, and assist with travel costs. The University of Washington will characterize the performance of the wireless charging system in the presence of lunar regolith and will contribute its Sensor Systems Lab to support realistic lunar environment testing and validation. Additionally, the GRC team will provide lunar advisory support as well as access to its VF-13 vacuum facility for “dirty” thermal vacuum testing to qualify the wireless charging system.

This wireless charging technology could have considerable utility not only on the Moon, but also in critical space applications on Mars, in orbit, and beyond. Future teams will be able to scale the wireless technology to diverse assets like lunar vehicles, power tools, flying systems, and more. The base station, power receiver, and CubeRover flight units will be delivered to NASA with the goal of being later infused into a near-term lunar mission via the Commercial Lunar Payload Services (CLPS) program in 2023.

(Left) Cedric Corpa de la Fuente, Electrical Engineer for Planetary Mobility at Astrobotic; (Middle) WiBotic’s existing wireless charging system. (Right) Astrobotic’s 2U CubeRover - the first space technology that will be integrated with the space-qualified wireless technology.
Lessons from the mind that guided the creation of the F-35  
(Continued from Page 1)

Remembering the whole history of aircraft design, starting with the bicycle-building Wright Brothers, Bevilaqua showed what he called “the wheel of misfortune” depicting 50 earlier attempts to invent an aircraft that could reliably take off and land vertically while still performing useful work. He said only one design succeeded, the British designed AV-8B Harrier jump jet that required top cover because its top speed was subsonic.

Bevilaqua, with advanced degrees in mathematics and aero engineering, said the first step was correctly stating the problem. “The way you state the problem determines the solution.”

The solution in the case of the F-35 required finding ways to accomplish each step in a process based upon associating knowns with creative thought in every facet of the program, including coordination between Skunk Works working groups. Bevilaqua noted that creative manufacturing projects must guard against errors caused by misunderstandings between design, fabrication and manufacturing, marketing and other groups.

Although the Joint Strike Fighter program called for a commonly shared airframe, variations were required for different customers. The Marine Corps variant required special thrust vectoring, propulsion cycling from turboshaft to turbo shaft mode for VTOL operation and an alternative jet engine for greater thrust. The propulsion system made the X-35 the first aircraft both fly supersonic and hover and land vertically. The development team won the Collier Trophy, which recognizes “the greatest achievement in aeronautics or astronautics in America” each year.

The Air Force version is stealthier and the Navy variant has more wing area and beefed-up airframe for carrier landings and takeoffs.

But even the best laid plans for cutting-edge research and development work to protect the nation unfortunately carry unhappy surprises on the back end.

Bevilaqua expressed two primary threats to happy landings for aerospace defense contractors. The first is cautioned about in the Skunk Works philosophy: “One miracle per program.” Technological miracles, such as making it possible for a jump jet to fly supersonic is about all any contractor can afford.

In the case of the F-35, Lockheed Martin used off-the-shelf technologies and components wherever they met requirements at the most affordable cost.

The second and potentially most costly threat to return on investment is found in the expression, “The high cost of a little more.”

Bevilaqua said the biggest financial problem to hit the F-35 program was the cost of agreeing to accept a new helmet display, which added substantially to the cost of the program without any productive outcome.

Such budget busting change and gold-plated add-ons can be driven externally or internally, Bevilaqua mentioned. From the customer’s perspective, “They want everything. They just don’t want to pay for it.”

And from the internal product development and marketing side, there is the too helpful sales pitch for an unnecessary gizmo or too fast agreement to a customer’s demand for an unneeded change.

No matter where the financial change hits, the defense contractor is exposed to the dreaded Pareto Principle of the 80/20 Rule, which roughly states, “the last 20 percent of the program drives 80 percent of the cost.” Bevilaqua pointed out that as has been seen in other recent aerospace technology leaps, including the B-2, “as the cost of weapons goes up, the number of units goes down.”

Although the unit costs of the F-35s coming off assembly lines have reportedly dropped in recent years, operational budgets for the fleet are reported to be increasing.
CLFA, that is FRACAS in a repair depot, seeks to "close the loop" between the failure noted and the repair made. In its most basic form, it does this by asking the question as to whether the part ultimately replaced can logically be connected to the field failure.

Why must CLFA be instituted? Won’t the repair depot automatically do this?

No. An affordable repair depot works to increase throughput while keeping costs down. Diagnosis is performed only to the extent needed to ensure a successful repair as judged by final acceptance test metrics. Large depots can contain many shops that perform their work somewhat independently of each other. A subsystem might be delivered to the depot and have a component removed and replaced and the subsystem is tested and sent out again. Meanwhile, the component may have a part removed and replaced and then the component is tested and placed on a shelf as a good spare. It is easy to ship bad actors back out to the field all the while your final acceptance tests look pretty good.

Have you ever tried to get something fixed, only to find it works OK when you show it to your repairman? Intermittent failures can cycle between depot and field, lowering field reliability rates while depot metrics seem OK.

Don’t get me wrong, the very affordable remove and replace strategy is a good one for speed, throughput, and efficient repair. But unfortunately, it has the potential to allow failed parts or components to remain in service and for emerging failure modes (those not thought of during design) to remain undetected.

Good and great sustainment organizations will enter into agreements with their depots to ensure repairs are traced back to failures and sufficient diagnostics are performed to ensure emerging failure modes are found.

What is sufficient? The more you do, the more you drive up your costs. Controls are appropriate.

Under CLFA, even if your program starts with 100% screening, it can quickly eliminate from scrutiny those failure modes and repairs that are well known or become well known after CLFA has functioned for a few years. For instance, you need not do a post mortem dissection on a faulty part with a well-known failure mechanism history.

On the other hand, a mature CLFA program will not limit its investigations to only weapon system operational failures. Subsystems and components can and do fail in the depot and elsewhere, revealing important weapon system assessment data concerning emerging failure modes. A mature CLFA program will also take the findings of its failure review board and use them to improve its own depot processes and equipment.

CLFA demands good processes and a good information management system to handle the large amounts of data generated and analyzed. These processes and data systems are also subject to improvements based on CLFA data.

Even with all these benefits to the depot itself, it is the sustainment organization that should step up and pay to start and continue CLFA at its depots. The diagnostic information is a key part of the "Observe System" step in the CSSMM we have been discussing in these articles.
The Military Lessons of Nagorno Karabakh

Military Lessons

There are three military lessons from the Nagorno-Karabakh war.

Precision weapons matter. This is the first and most important lesson of the war. The use of drones, loitering munitions and precision missiles changed the war's outcome. The steady destruction of Armenian hardware --タンクs, 車両, 大砲, 飛行機 -- demonstrated that these new weapons were decisive. The Russian newspaper Sputnik reported that Armenia lost 241 battle tanks, 4 S-300s and 2 Scud Elbrus tactical missile systems; while Azerbaijani troops captured 39 tanks and 24 BMPs.

These are staggering losses. For the record, the number of tanks reported lost is more than the number of tanks publicly listed in the Armenian army inventory. But the fact that the Russians are reporting the number is significant since these are all Russian main battle tanks (T90's and T-72s). The loss of 4 S-300's is also a major victory against a top Russian system. The Sputnik report does not cover other air defense systems knocked out by Azerbaijani drones. Nor does the Sputnik report cover the destruction of two types of multiple launch rocket systems used by Armenia --namely Smersh BM 30 MLRS and Grad BM-21 MLRS. Videos have shown both types of MLRS destroyed by Turkish drones.

Azeri losses were much smaller. According to at least one report, Azerbaijan lost 26 tanks (models not specified) and 24 drones (types not specified but mainly Bayraktar TB2 drones). Azerbaijan appears to have lost some surveillance drones and at least one Harop.

None of the loss figures should be considered authoritative or accurate. However, Azerbaijan has published numerous videos of drone attack successes including destroyed tanks, BMP armored personnel carriers, Smersh and Grad multiple launch rocket systems, command centers, and troop transports (replete with flying bodies) to make clear they had great success in this kind of warfare almost to the point where if Armenia risked a wider conflict it would have little equipment to fight with against Azerbaijan.

Air power played almost no role in the fighting. According to the Azeri Ministry of Defense, Azeri forces shot down three Armenian Su-25's. The Su-25 is primarily a ground attack aircraft that the Russians still use and which also is in the inventories of many countries. While it has been upgraded, the Su-25 is slow, subsonic and lacks a modern missile warning system. Su-25's were shot down by Turkey's F-16's in Syria and Libya. At least one of the three shot down in the Nagorno-Karabakh conflict was taken out by a Turkish F-16 deployed to Azerbaijan. Azerbaijan says the other two Su-25's were destroyed by Azerbaijan’s S-300 system.

One of the key lessons for Russia and its clients and partners is that the Su-25 should be retired sooner rather than later.

Both countries have small and mostly outdated air forces. Whether in the future that will change isn't clear. Armenia has four Su-30 fighters in its inventory, and has apparently ordered eight more. These are formidable aircraft, but if they were used in the war they would have found themselves up against Turkey's F-16's. This is a confrontation the Russians did not want to happen, as it would have meant a bigger war with more Turkish Air Force assets committed to the fight. Turkey shares a border with Armenia.

Clearly Turkey checkmated any use of more advanced airpower by Armenia and Russia certainly made it clear it did not want the Su-30's in the fight.

Loitering munitions and unique tactics destroyed Russian supplied air defenses. The Israeli loitering munition called Harop was very effective in destroying Russia-supplied S-300's and other systems that use radar for surveillance or targeting.

Harop has a range of 1,000 km (621 miles) and can loiter for up to nine hours. It can be operated with a man in the loop or it can operate autonomously. In autonomous mode it can't be jammed electronically meaning that if you detect it you must destroy it kinetically. Harop works by detecting a specified radiation source such as a working radar or a command post with active radio transmitters. Harop is extremely accurate with a CEP (circular error of probability of a hit) of less than 1 meter (less than 3 feet). It also features a stealthy design, making radar detection of Harop difficult.
The Military Lessons of Nagorno Karabakh (Continued from the Previous Page)

Russian air defenses had great difficulty in detecting drones. It is likely that the radars used in systems such as the S-300 are not capable of seeing small, lightweight drones or by the time they see them the drones have already launched their weapons. Harop’s and other loitering munitions are suicide drones, meaning that the drone crashes into the target. It was only late in the war when the Russians brought the Krakushka system into the conflict. Krakushka is a broadband multifunctional jamming station manufactured by KRET (“Concern Radio Electronic Technologies”), part of the Rostec Group that can take out a drones positive control system and cut off GPS signals. The Russian press reported that Krakushka managed to knock out around 12 Bayraktar drones. The Bayraktar requires a man in the loop.

Most of the Bayraktar drone strikes and many of the videos taken by surveillance drones appear to the author to be at relatively low altitude, perhaps 600 to 1200 meters height and about one mile slant range from the target. This suggests very poor performance by Russian-made air defenses.

Azerbaijan also used a saturation tactic, flying An-2 biplanes over enemy targets to light up their radars, letting the drones come in from behind to knock them out. There are two reports on this: one of them has it that the AN-2 biplanes were automated and thus were not piloted. The other report is that the pilots flew the planes to near the target, tied ropes or belts around the control stick and then bailed out. The bail out technique recalls the tragic Aphrodite mission in World War II where the US used as suicide bombers B-17 Flying Fortress and PB4Y bombers as munitions against bunkers and other hardened enemy facilities. In Aphrodite the operators were supposed to bail out at the last moment. On one of these missions John F. Kennedy's older brother, Joseph Jr., lost his life. (For more information see Aphrodite: Desperate Mission by Jack Olsen.) It also partly recalls Japan’s Kamikaze missions, but here the pilots flew the aircraft directly into the target and were killed.

Azerbaijan used the An-2’s only as decoys. There is a report that at least one of the pilots died when bailing out.

Conclusion

Russia will need to evaluate the performance of its weapons used in the Nagorno-Karabakh conflict. Too many Russian-supplied major systems were knocked out and many of Russia’s better systems, such as Smersh and S-300, were vulnerable to drone attack and did not survive.

Turkey should be pleased with the excellent performance of the Bayraktar drones it supplied, although the survivability of these drones in future is uncertain. The Russians need to improve their air defenses, especially radars and it is likely they will do so. Other countries, such as the United States, have to pay far more attention to counter-drone systems.

Israel has to be happy with Harop and LORA, both performed very well and probably account for knocking out high value targets. One can expect sales for both products to rise accordingly.

Israel also supplied air defense systems to Azerbaijan including Iron Dome and Barak 8. As yet there are no reports available on their performance.

Azerbaijan stayed in the fight and was far more professional than its forces were in 1991-1992. Its use of technology grafted on top of Russian-supplied hardware turned out to be decisive.

Armenia took a big hit in the war and lost many soldiers and most of its fighting capability. It will take years to replace the hardware. Manpower is another looming problem for the future, since Armenia is now badly exposed because of its overall losses.

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.
Wokeists Assault Space Exploration (Continued from Page 5)

through space, and reentry and landing on Earth. They were therefore never sterilized, and if any microbes had existed in them when they left the Red Planet, they readily could have survived the trip. If there are, or ever were, microbes on the Martian surface, they have long since arrived here in large numbers, and continue to do so today. So the very expensive alterations to Mars sample-return mission designs demanded by the NASA Planetary Protection Office to preclude release of Martian microbes on earth are as nonsensical as ordering the border patrol to search all cars crossing our northern border to make sure that no one is importing Canada geese.

The issue of forward contamination has been of greater concern to the planetary science community. It is true that a good life-detection experiment requires a sterile apparatus. But this can be provided by experimental discipline, rather than by attempting to sterilize or quarantine an entire planet. Indeed, quarantining Mars is no more possible than quarantining the Earth, because just as Martian materials have been coming to Earth, terrestrial rocks have been traveling to Mars since the dawn of the solar system.

In order to allow any Mars surface science missions to proceed at all, NASA's Planetary Protection Office has relaxed its sterilization requirements for missions that do not include life-detection experiments. But rather than assist in the search for life on Mars, the PPO's more stringent requirements for such missions has simply prevented them, with no life-detection experiments being sent to Mars since 1976. The situation has gotten so bad that a group of leading astrobiologists wishing to send a life-detection experiment to the Red Planet has had to propose it as a sterility-certification experiment, to identify a location without life to serve as a science-free reservation for astronauts.

The idea that after half a century without a life-detection mission being sent to Mars, NASA should spend billions of dollars of the taxpayers’ money and a decade’s worth of the efforts of a talented team of scientists and engineers to create one, only to send it to a place where it is least likely to find life, is patently absurd. Yet this is what the planetary-protection program has reduced us to.

The early Mars was a warm and wet planet, not unlike the early Earth. It could have evolved life, but did it? If it did, is that life still there, and does it use the same DNA/RNA information system that governs the design, reproduction, and evolutionary capabilities of all terrestrial life? Or does it use an entirely different system? These are questions of extraordinary scientific and philosophical interest bearing on the potential prevalence and diversity of life in the universe.

Accordingly, we should certainly send life-detection experiments to Mars, targeted, of course, to locations where they are most likely to find life, not least likely. And if they do detect life, that is precisely where we should send astronauts, to do, on site, the kind of complex research needed to properly characterize Martian life that only human scientists can do.

The planetary protectionist objection that if astronauts go to Mars there is no way one could know if any microbes they found were native or transports is without merit. Human explorers on Mars could know that any life they found was there before them by the same means that human explorers on Earth know there was life here before us: fossils. Any Mars native life found in the present must also have been there in the past, and if it were, it would have left fossils or other biomarker residues. To deny that such fossils prove the existence of prehuman life, the planetary protectionists would need to argue, as creationists do, that Mars was created with fossils embedded in its geology in order to test our faith. Rather than expose themselves to mockery by making such a case, however, they have simply chosen to act arbitrarily.

Existing planetary-protection rules essentially preclude humans landing on Mars, because there is no way one could ever assure that a crewed spacecraft wouldn’t crash, distributing human-carried microbes all over the landscape. This is a real problem for NASA’s human-exploration ambitions. Indeed, NASA’s Apollo moon-landing program would have been quite impossible under recent planetary-protection guidelines. For this reason, NASA administrator Jim Bridenstine authorized a commission headed by New Horizon Pluto mission principal investigator Dr. Alan Stern, which issued a set of recommendations to liberalize planetary-protection rules to make human lunar missions possible again. The EDIWG authors are clearly upset about this development.
and concerned that it might be extended to allow human missions to Mars as well. However, since planetary protection can’t really be defended on scientific grounds, they insist that alternative criteria be adopted. Specifically, they recommend a combination of ancient pantheistic mysticism and postmodern socialist thought.

As a methodology for understanding the natural world, mysticism has been displaced for some time by Western rationalism. The EDIWG authors therefore devote a good part of their paper to defaming Western civilization, basing themselves on the authority of the 1619 Project and similar post-rational scholarship. “Colonial expansion and the trans-Atlantic slave trade have been foundational to our present world,” they say, ignoring the fact that it was actually the scientific and industrial revolutions which were foundational to our current world that liberated humanity from the various forms of slavery which characterized all preceding societies. “What we call globalization” they continue, “is the culmination of a process that began with the constitution of America and the colonial/modern Eurocentered capitalism as a new global power. The result is a world where political and economic systems, namely capitalism, prioritize profit over human welfare, producing an environmental crisis, and vast inequities further compounded by climate change,” etc., etc.

Western civilization is certainly not innocent of all crime, particularly against the native populations of colonial domains. But the root of such crimes was failure of the West in some instances to stand by its own revolutionary principles setting forth inalienable rights for all of humanity. In contrast, while striking an anti-imperialist pose, the EDIWG authors deeply degrade indigenous peoples by describing them as a part of an ecosystem, making offenses against them not violations of human rights, but a form of environmental damage. On this basis, they advance the thesis that harming microbes would be as immoral as anything that was done to Native Americans or Africans. “There must be further discussion of what moral consideration microbial life on other worlds should have, beyond their scientific significance,” they say. “Consideration of ‘intelligence’ or ‘non-intelligence’ should not be used as a framework in this discussion. Not only do biological distinctions of intelligence have a racist history, they do not hold scientific merit. It is clear that microbiology is foundational to Earth as we know it, and microbes are deserving of moral consideration.”

Having embraced an ethical system that would preclude the use of antibiotics, thereby imperiling modern civilization on Earth, the authors propose to abort it on Mars altogether:

A human presence on Mars will bring bio contaminants and irreversibly contaminate the planet, both with whole organisms and their chemical constituents. This poses extreme concerns for the ability to conduct sound astrobiology to identify ancient or present life, but a larger moral concern as well. . . . Therefore, it is of paramount importance to consider the ethics of any crewed mission to Mars prior to such an expedition, including an assessment of the structures supporting the project and their intent, to ensure mission design can be impacted by these considerations. [Bold type in original.]

But what if Mars should prove to be lifeless, could we settle it then? Sorry, no dice. “Even if there is no extant microbial life on Mars or beyond, we must consider the impacts of our actions on geological timescales,” they say. “A human presence on an astrobiologically significant world could disrupt evolutionary processes already in place. What moral obligation do we have towards potential future life that our presence on Mars could impact, or to hybrid forms of life that our presence could potentially create? These questions must be addressed by planetary protection policy.”

Planetary-protection policy, the authors say, must not be limited to consideration of actual life or potential life. “Aesthetics should also be considered. If Moon mining is to be an extensive enterprise as planned, these changes will be visible from Earth,” they claim, “fundamentally changing one of the few communal human experiences of gazing at the Moon. In addition, the Moon and other planetary bodies are sacred to some cultures. Is it possible for those beliefs to be respected if we engage in resource utilization on those worlds?”

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**Wokeists Assault Space Exploration** *(Continued from the Previous Page)*

In posing this issue, the EDIWG authors have embraced the arguments of other contemporary putative ethicists who have advanced the claim that extraterrestrial bodies such as the Moon have a “right” to remain unchanged. But clearly the Moon is a dead rock. It cannot do anything, or desire to do anything. So such discussions are not really about establishing rights for the Moon, but denying them to humans.

Furthermore, if the self-proclaimed representative of any tribe anywhere can stop space development by claiming that it violates their ancient sacred teachings, such development is unlikely to proceed. The authors are fine with this. As they put it, “[it] is worth questioning whether our current mode of extractive capitalism is something we should take with us when interacting with other worlds.” Furthermore, helping to meet the needs of humanity by entrepreneurial development of resources from space would be a bad thing, because “enabling those with the wealth to privately engage in space exploration efforts could exacerbate already extreme wealth inequality in the immediate future.”

The fundamental issue at hand, the authors make clear, however, is not merely suppressing human enterprise in space, but on Earth as well. “Ultimately, we must build a better, moral, and livable future because that is how we will survive on our own planet. . . . Dismantling the structures that govern our current world and building new ones will not be easy. We are calling on the decadal committee to engage in that fight.”

In his play, The Birds, the ancient Greek satirist Aristophanes described an avian plot to take over the universe by building a wall across the sky. This, the birds hoped, would cut the gods off from their essential nourishment of sacrificial smoke, thereby forcing their surrender.

The birds were trying to lock the gods out, the EDIWG authors want to wall humanity in. But as the failure of the birds’ plot shows, that job can’t be done using bricks.

So planetary protection is the answer.

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Astrobotic Unveils New 47,000sq.ft. Headquarters in Pittsburgh, PA
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functionality in the unique environment of the Moon. We’ll also fly science instruments, so we’ll obtain important scientific data to help inform our future exploration missions,” says Ryan Stephan, NASA Commercial Lunar Payload Services (CLPS) Payload Integration Manager.

Astrobotic’s new headquarters is located in Pittsburgh’s Northside, home to five historical districts. The headquarters is within a mile of several popular cultural destinations, including The Carnegie Science Center, Heinz Field, Stage AE the National Aviary, and the Children’s Museum.

“The innovation sector in Pennsylvania, and especially here in Pittsburgh, has been a powerhouse for the Commonwealth. And that’s thanks to companies like Astrobotic who have operated and grown here in Pittsburgh since their founding thirteen years ago... Astrobotic is at the forefront of developing advanced robotics for lunar operations that will help propel the industry into the future and further cement Pittsburgh’s status as an international hub,” says Eric Bitar, Governor’s Action Team (GAT) SW Director.

“It’s really a story about what Pittsburgh has always been,” says Allegheny County Executive Rich Fitzgerald. “We’ve always been a place of innovation. Always a place of the next technology…”

“I was five years old when we landed on the Moon. By the time I was six years old, I could name every planet. And that is an opportunity that is now down the street for every young Pittsburgh child. This is the technology of the engineers, and the dreamers, and the scientists from our region. And this is the product that you [Astrobotic] have given us to give to the world,” says Mayor Bill Peduto, Mayor of the City of Pittsburgh.

“Technology and robotics give Pittsburgh a competitive edge, and companies like Astrobotic – a venture that’s successfully commercialized its advanced space robotics capabilities and is a rising star – are catalyzing interest in Pittsburgh, creating job growth and carrying the banner for this region’s unrelenting drive to innovate, shape the world and own the future,” said Mark Anthony Thomas, president of the Pittsburgh Regional Alliance, the region’s economic development organization. “As one of the largest private facilities of its kind anywhere, Astrobotic’s new headquarters and lunar operations facility is proof that remarkable things are happening in Pittsburgh.”

At the opening ceremony, and as Astrobotic employees return to work at the new facility, the company has required masks and limited building capacity to allow for greater social distancing due to the COVID-19 pandemic. Astrobotic has also enlisted Checklist Facility Maintenance cleaning services to maintain high sanitary standards.

Astrobotic CEO John Thornton chats with Mayor Peduto, Mayor of the City of Pittsburgh, before the tour of Astrobotic’s new headquarters.

Pictured left to right: Dan Hendrickson, Astrobotic Vice President of Business Development; David Malone, Chairman of the SIF, Chairman and CEO of Gateway Financial; U.S. Congressman Conor Lamb; Sharad Bhaskaran, Astrobotic Mission Director for Peregrine Mission One.

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Astrobotic Unveils New 47,000sq.ft. Headquarters in Pittsburgh, PA

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U.S. Secretary of Commerce Wilbur Ross makes remarks to a socially-distanced crowd at Astrobotic’s grand opening ceremony.

U.S. Congressman Conor Lamb chats in Astrobotic's Mission Control Room, where commercial customers and NASA will operate scientific instruments on the lunar surface.

LaShawn Burton Faulk, Executive Director of Manchester Citizens Corporation, provides comments to the Astrobotic film crew.

Ander Solorzano, Astrobotic Systems Engineer, stands beside the Peregrine Structural Test Model.

Ander Astrobotic's VIP room overlooks Mission Control.

Astrobotic's open office area.
What the Pandemic Has Taught Us About Science (Continued from Page 7)

to prevent the spread of respiratory diseases (though one is now under way in Denmark). In the West, unlike in Asia, there were months of disagreement this year about the value of masks, culminating in the somewhat desperate argument of mask foes that people might behave too complacently when wearing them. The scientific consensus is that the evidence is good enough and the inconvenience small enough that we need not wait for absolute certainty before advising people to wear masks.

This is an inverted form of the so-called precautionary principle, which holds that uncertainty about possible hazards is a strong reason to limit or ban new technologies. But the principle cuts both ways. If a course of action is known to be safe and cheap and might help to prevent or cure diseases—like wearing a face mask or taking vitamin D supplements, in the case of Covid-19—then uncertainty is no excuse for not trying it.

A fourth mistake is to gather data that are compatible with your guess but to ignore data that contest it. This is known as confirmation bias. You should test the proposition that all swans are white by looking for black ones, not by finding more white ones. Yet scientists “believe” in their guesses, so they often accumulate evidence compatible with them but discount as aberrations evidence that would falsify them—saying, for example, that black swans in Australia don’t count. Advocates of competing theories are apt to see the same data in different ways. Last January, Chinese scientists published a genome sequence known as RaTG13 from the virus most closely related to the one that causes Covid-19, isolated from a horseshoe bat in 2013. But there are questions surrounding the data. When the sequence was published, the researchers made no reference to the previous name given to the sample or to the outbreak of illness in 2012 that led to the investigation of the mine where the bat lived. It emerged only in July that the sample had been sequenced in 2017-2018 instead of post-Covid, as originally claimed.

These anomalies have led some scientists, including Dr. Li-Meng Yan, who recently left the University of Hong Kong School of Public Health and is a strong critic of the Chinese government, to claim that the bat virus genome sequence was fabricated to distract attention from the truth that the SARS-CoV-2 virus was actually manufactured from other viruses in a laboratory. These scientists continue to seek evidence, such as a lack of expected bacterial DNA in the supposedly fecal sample, that casts doubt on the official story.

By contrast, Dr. Kristian Andersen of Scripps Research in California has looked at the same confused announcements and stated that he does not “believe that any type of laboratory-based scenario is plausible.” Having checked the raw data, he has “no concerns about the overall quality of [the genome of] RaTG13.”

Given that Dr. Andersen’s standing in the scientific world is higher than Dr. Yan’s, much of the media treats Dr. Yan as a crank or conspiracy theorist. Even many of those who think a laboratory leak of the virus causing Covid-19 is possible or likely do not go so far as to claim that a bat virus sequence was fabricated as a distraction. But it is likely that all sides in this debate are succumbing to confirmation bias to some extent, seeking evidence that is compatible with their preferred theory and discounting contradictory evidence.

Dr. Andersen, for instance, has argued that although the virus causing Covid-19 has a “high affinity” for human cell receptors, “computational analyses predict that the interaction is not ideal” and is different from that of SARS, which is “strong evidence that SARS-CoV-2 is not the product of purposeful manipulation.” Yet, even if he is right, many of those who agree the virus is natural would not see this evidence as a slam dunk.

As this example illustrates, one of the hardest questions a science commentator faces is when to take a heretic seriously. It’s tempting for established scientists to use arguments from authority to dismiss reasonable challenges, but not every maverick is a new Galileo. As the astronomer Carl Sagan once put it, “Too much openness and you accept every notion, idea and hypothesis—which is tantamount to knowing nothing. Too much skepticism—especially rejection of new ideas before they are adequately tested—and you’re not only unpleasantly grumpy, but also closed to the advance of science.” In other words, as some wit once put it, don’t be so open-minded that your brains fall out.

(Continued on the Next Page)
What the Pandemic Has Taught Us About Science (Continued from the Previous Page)

Peer review is supposed to be the device that guides us away from unreliable heretics. A scientific result is only reliable when reputable scholars have given it their approval. Dr. Yan’s report has not been peer reviewed. But in recent years, peer review’s reputation has been tarnished by a series of scandals. The Surgisphere study was peer reviewed, as was the study by Dr. Andrew Wakefield, hero of the anti-vaccine movement, claiming that the MMR vaccine (for measles, mumps and rubella) caused autism. Investigations show that peer review is often perfunctory rather than thorough; often exploited by chums to help each other; and frequently used by gatekeepers to exclude and extinguish legitimate minority scientific opinions in a field.

Herbert Ayres, an expert in operations research, summarized the problem well several decades ago: “As a referee of a paper that threatens to disrupt his life, [a professor] is in a conflict-of-interest position, pure and simple. Unless we’re convinced that he, we, and all our friends who referee have integrity in the upper fifth percentile of those who have so far qualified for sainthood, it is beyond naive to believe that censorship does not occur.” Rosalyn Yalow, winner of the Nobel Prize in medicine, was fond of displaying the letter she received in 1955 from the Journal of Clinical Investigation noting that the reviewers were “particularly emphatic in rejecting” her paper.

This year has driven home as never before the message that there is no such thing as ‘the science’; there are different scientific views.

The health of science depends on tolerating, even encouraging, at least some disagreement. In practice, science is prevented from turning into religion not by asking scientists to challenge their own theories but by getting them to challenge each other, sometimes with gusto. Where science becomes political, as in climate change and Covid-19, this diversity of opinion is sometimes extinguished in the pursuit of a consensus to present to a politician or a press conference, and to deny the oxygen of publicity to cranks. This year has driven home as never before the message that there is no such thing as “the science”; there are different scientific views on how to suppress the virus.

Anthony Fauci, the chief scientific adviser in the U.S., was adamant in the spring that a lockdown was necessary and continues to defend the policy. His equivalent in Sweden, Anders Tegnell, by contrast, had insisted that his country would not impose a formal lockdown and would keep borders, schools, restaurants and fitness centers open while encouraging voluntary social distancing. At first, Dr. Tegnell’s experiment looked foolish as Sweden’s case load increased. Now, with cases low and the Swedish economy in much better health than other countries, he looks wise. Both are good scientists looking at similar evidence, but they came to different conclusions.

Having proved a guess right, scientists must then repeat the experiment. Here too there are problems. A replication crisis has shocked psychology and medicine in recent years, with many scientific conclusions proving impossible to replicate because they were rushed into print with “publication bias” in favor of marginally and accidentally significant results. As the psychologist Stuart Ritchie of Kings College London argues in his new book, “Science Fictions: Exposing Fraud, Bias, Negligence and Hype in Science,” unreliable and even fraudulent papers are now known to lie behind some influential theories.
What the Pandemic Has Taught Us About Science (Continued from the Previous Page)

For example, “priming”—the phenomenon by which people can be induced to behave differently by suggestive words or stimuli—was until recently thought to be a firmly established fact, but studies consistently fail to replicate it. In the famous 1971 Stanford prison experiment, taught to generations of psychology students, role-playing volunteers supposedly chose to behave sadistically toward “prisoners.” Tapes have revealed that the “guards” were actually instructed to behave that way. A widely believed study, subject of a hugely popular TED talk, showing that “power posing” gives you a hormonal boost, cannot be replicated. And a much-publicized discovery that ocean acidification alters fish behavior turned out to be bunk.

The famous 1971 Stanford prison experiment, which purported to show how assigned roles shape behavior, has been debunked by new evidence.

Prof. Ritchie argues that the way scientists are funded, published and promoted is corrupting: “Peer review is far from the guarantee of reliability it is cracked up to be, while the system of publication that’s supposed to be a crucial strength of science has become its Achilles heel.” He says that we have “ended up with a scientific system that doesn’t just overlook our human foibles but amplifies them.”

At times, people with great expertise have been humiliated during this pandemic by the way the virus has defied their predictions. Feynman also said: “Science is the belief in the ignorance of experts.” But a theoretical physicist can afford such a view; it is not much comfort to an ordinary person trying to stay safe during the pandemic or a politician looking for advice on how to prevent the spread of the virus. Organized science is indeed able to distill sufficient expertise out of debate in such a way as to solve practical problems. It does so imperfectly, and with wrong turns, but it still does so.

How should the public begin to make sense of the flurry of sometimes contradictory scientific views generated by the Covid-19 crisis? There is no shortcut. The only way to be absolutely sure that one scientific pronouncement is reliable and another is not is to examine the evidence yourself. Relying on the reputation of the scientist, or the reporter reporting it, is the way that many of us go, and is better than nothing, but it is not infallible. If in doubt, do your homework.

Appeared in the October 10, 2020, print edition as 'What the Pandemic Has Taught Us About Fallible Science in a Covid-Struck World.'

About the Author: Matt Ridley’s books have sold over a million copies, been translated into 31 languages and won several awards. His books include The Red Queen, The Origins of Virtue, Genome, Nature via Nurture, Francis Crick, The Rational Optimist and The Evolution of Everything. His TED talk "When Ideas Have Sex" has been viewed more than two million times.

He writes a weekly column in The Times (London) and writes regularly for the Wall Street Journal.

As Viscount Ridley, he was elected to the House of Lords in February 2013. He served on the science and technology select committee 2014-2017.

With BA and DPhil degrees from Oxford University, Matt Ridley worked for the Economist for nine years as science editor, Washington correspondent and American editor, before becoming a self-employed writer and businessman.

He was founding chairman of the International Centre for Life in Newcastle. He was non-executive chairman of Northern Rock plc and Northern 2 VCT plc.

He also commissioned the Northumberlandia landform sculpture and country park.

He founded the Mind and Matter column in the Wall Street Journal in 2010.

He won the Hayek Prize in 2011, the Julian Simon award in 2012 and the Free Enterprise Award from the Institute of Economic Affairs in 2014.

He is a fellow of the Royal Society of Literature and of the Academy of Medical Sciences, and a foreign honorary member of the American Academy of Arts and Sciences. He is honorary president of the International Centre for Life in Newcastle.

He has honorary doctorates from Buckingham University, Cold Spring Harbor Laboratory and University Francisco Marroquin, Guatemala.

He is married to the neuroscientist Professor Anya Hurlbert.

They have two children and live in Northumberland in the north of England.
NASA’s OSIRIS-REx Spacecraft Successfully Touches Asteroid
(Continued from Page 8)

Captured on Aug. 11, 2020 during the second rehearsal of the OSIRIS-REx mission’s sample collection event, this series of images shows the SamCam imager’s field of view as the NASA spacecraft approaches asteroid Bennu’s surface. The rehearsal brought the spacecraft through the first three maneuvers of the sampling sequence to a point approximately 131 feet (40 meters) above the surface, after which the spacecraft performed a back-away burn.

Credits: NASA/Goddard/University of Arizona

“It’s hard to put into words how exciting it was to receive confirmation that the spacecraft successfully touched the surface and fired one of the gas bottles,” said Michael Moreau, OSIRIS-REx deputy project manager at NASA’s Goddard Space Flight Center in Greenbelt, Maryland. “The team can’t wait to receive the imagery from the TAG event late tonight and see how the surface of Bennu responded to the TAG event.”

The spacecraft carried out TAG autonomously, with pre-programmed instructions from engineers on Earth. Now, the OSIRIS-REx team will begin to assess whether the spacecraft grabbed any material, and, if so, how much; the goal is at least 60 grams, which is roughly equivalent to a full-size candy bar.

OSIRIS-REx engineers and scientists will use several techniques to identify and measure the sample remotely. First, they’ll compare images of the Nightingale site before and after TAG to see how much surface material moved around in response to the burst of gas.

“Our first indication of whether we were successful in collecting a sample will come on October 21 when we downlink the back-away movie from the spacecraft,” Moreau said. “If TAG made a significant disturbance of the surface, we likely collected a lot of material.”

Next, the team will try to determine the amount of sample collected. One method involves taking pictures of the TAGSAM head with a camera known as SamCam, which is devoted to documenting the sample-collection process and determining whether dust and rocks made it into the collector head. One indirect indication will be the amount of dust found around the sample collector head. OSIRIS-REx engineers also will attempt to snap photos that could, given the right lighting conditions, show the inside of the head so engineers can look for evidence of sample inside of it.

These images show the OSIRIS-REx Touch-and-Go Sample Acquisition Mechanism (TAGSAM) sampling head extended from the spacecraft at the end of the TAGSAM arm. The spacecraft’s SamCam camera captured the images on Nov. 14, 2018 as part of a visual checkout of the TAGSAM system, which was developed by Lockheed Martin Space to acquire a sample of asteroid material in a low-gravity environment. The imaging was a rehearsal for a series of observations that will be taken at Bennu directly after sample collection. Credits: NASA/Goddard/University of Arizona

A couple of days after the SamCam images are analyzed, the spacecraft will attempt yet another method to measure the mass of the sample collected by determining the change in the spacecraft’s “moment of inertia,” a phrase that describes how mass is distributed and how it affects the rotation of the body around a central axis. This maneuver entails extending the TAGSAM arm out to the side of the spacecraft and slowly spinning the spacecraft about an axis perpendicular to the arm. This technique is analogous to a person spinning with one arm

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NASA’s OSIRIS-REx Spacecraft
(Continued from the Previous Page)

extended while holding a string with a ball attached to
the end. The person can sense the mass of the ball by the
tension in the string. Having performed this maneuver
before TAG, and now after, engineers can measure the
change in the mass of the collection head as a result of
the sample inside.

“We will use the combination of data from TAG and the
post-TAG images and mass measurement to assess our
confidence that we have collected at least 60 grams of
sample,” said Rich Burns, OSIRIS-REx project manager
at Goddard. “If our confidence is high, we’ll make the
decision to stow the sample on October 30.”

To store the sample, engineers will command the robotic
arm to place the sample collector head into the Sample
Return Capsule (SRC), located in the body of the
spacecraft. The sample arm will then retract to the side of
the spacecraft for the final time, the SRC will close, and
the spacecraft will prepare for its departure from Bennu
in March 2021 — this is the next time Bennu will be
properly aligned with Earth for the most fuel-efficient
return flight.

If, however, it turns out that the spacecraft did not collect
enough sample at Nightingale, it will attempt another
TAG maneuver on Jan. 12, 2021. If that occurs, it will
touch down at the backup site called “Osprey,” which is
another relatively boulder-free area inside a crater near
Bennu’s equator.

OSIRIS-REx launched from Cape Canaveral Air Force
Station in Florida Sept. 8, 2016. It arrived at Bennu Dec.
3, 2018, and began orbiting the asteroid for the first time
on Dec. 31, 2018. The spacecraft is scheduled to return to
Earth Sept. 24, 2023, when it will parachute the SRC into
Utah’s west desert where scientists will be waiting to
collect it.

Goddard provides overall mission management, systems
engineering and the safety and mission assurance for
OSIRIS-REx. Dante Lauretta of the University of
Arizona, Tucson, is the principal investigator, and the
University of Arizona also leads the science team and the
mission’s science observation planning and data
processing. Lockheed Martin Space in Denver built the
spacecraft and is providing flight operations. Goddard
and KinetX Aerospace are responsible for navigating the
OSIRIS-REx spacecraft. OSIRIS-REx is the third
mission in NASA’s New Frontiers Program, which is
managed by NASA’s Marshall Space Flight Center in
Huntsville, Alabama, for the agency’s Science Mission
Directorate in Washington.

For more information on OSIRIS-REx:

https://www.nasa.gov/osiris-rex

and

https://www.asteroidmission.org
touch the stars? I received answers from different people and they were alright. But, I wanted to find my own answers and so I started reading books on science. I stayed back every day in school from 6th grade onwards to read books in the library. From rocket propulsion to the moon landings, I read everything that was available and that made me realise the importance of STEM. I finally realised that science is not just theoretical knowledge but a way of thinking and imagining what we are, where we are, who we are and what we can be. I want every individual to experience the joy of researching, experimenting, creating and learning. STEM education and courageous application of knowledge and teamwork. It enables you to experiment and learn from your mistakes and advance with the world. It also develops problem solving skills and resilience leading to new innovative ideas.

Part of the reason why I love space science is exploration. The Apollo missions, experiments aboard the ISS, the launch of SpaceX Crew Dragon, New Horizons, Mangalyaan, Curiosity and the list goes on. There are so many dedicated people engaged in these missions. I am not just talking about the scientists and engineers who make it happen, but all the citizens of planet earth who cheer for the success of these missions. Space exploration Unites and is all irrespective of language, nationality, colour or background. It is so broad and welcoming. Today, we are all gathered together to support the idea of habitation on Mars. Together we will build a safe future.

Talking about Mars, I remember that in 1969, Mariner 6 and 7 were sent to the Red Planet to measure its ionosphere. That is when we discovered that its atmosphere was mainly composed of carbon dioxide. This was later confirmed by the Viking 1 and 2 missions. Then, nobody had realised that rocket fuel could be synthesized out of this air. In the 1980s, Martian meteorites confirmed the presence of a substance in its soil that could be converted into a building material.

For the past one and a half decade, space engineers and scientists have been working on several unmanned missions to Mars. Mars Pathfinder, Mars Global Surveyor, Mars Climate Orbiter, Mars Polar Lander, Curiosity, Perseverance and so many others. This search for a habitable environment and extraterrestrial life has generated exceptional innovations that we benefit from everyday. It is now time to send humans to Mars and I cannot wait! We are going there to find the evidence of life and if we don’t find it, we want to establish our own.

Space exploration in general has provided much of the technology that we use today. Inhabiting Mars would possibly help solve the biggest challenges that we face today. The reasons for going and settling on Mars will be different, depending on who you ask but mine is that going to the Red Planet will not only test our knowledge, but also the limits of our abilities in every way. It is the challenge of a lifetime!

In a world that is filled with unexpected challenges and situations, going to Mars becomes all the more important. This year has definitely been challenging and unpredictable for all of us. It is also the year that I was set to graduate, and like everyone, I had to stay indoors. Thus, I could not meet my friends or go out even for a walk. But even in this inevitable situation, I was truly grateful for Ms. Janet Ivey’s Online Astronaut Academy and the Mars webinar series by Explore Mars. Everyday we had a new guest who educated us about space science, technology, astronomy, mathematics, music and even literature. Ms. Artemis Westenberg also held sessions about Women in Space, which I found truly insightful. Everyday at 8:45 AM EST, I would sit with my notebook and pen, and wait for the session to begin. I met Dr. Tanya Harrison, Mr. Steve Sherman, Mr. Graham Lau, Dr. Kenneth Carpenter, Astronaut Don, Astronaut Wendy, Captain Wally Funk, Ms. Rhonda Stevenson and so many other phenomenal minds for the first time in my life. After nine weeks, we held the graduation ceremony. I could see the sadness in everyone’s eyes and the reluctance to say goodbye, even if it was only for a few weeks. We started JP’s Online Emporium of Science and Wonder again in the month of June and it continues to be the highlight of my days.

Through Ms. Janet’s virtual classes and the online webinars by Explore Mars, students and adults around the globe have been educated about space exploration. Now we are becoming ready to take the first step for all humankind. Let us persevere together for the day when we can eat ice cream on the Red Planet.

There is something called ikigai. It is a Japanese word. It translates to the thing that gets you up in the morning.

Mars is my ikigai.”

Tapaswini Sharma (Portrait Credits by DIAMONDS MIRROR Artist Reza Jozani)
2020 NASA Tipping Point Selections *(Continued from Page 12)*
Masten Space Systems of Mojave, California, $2.8 million
Build and demonstrate a universal chemical heat and electrical power source attachment that lets payloads survive the extreme environments encountered during the lunar night and in craters.

• **Nokia of America Corporation of Sunnyvale, California, $14.1 million**
  Inspired by terrestrial technology, Nokia proposes to deploy the first LTE/4G communications system in space. The system could support lunar surface communications at greater distances, increased speeds, and provide more reliability than current standards.

• **pH Matter of Columbus, Ohio, $3.4 million**
  Develop and demonstrate a reversible, regenerative fuel cell capable of producing power and storing energy on the lunar surface. The technology could run the future infrastructure that processes water harvested on the Moon and creates propellant and other mission consumables. The small business will collaborate with Glenn.

• **Precision Combustion Inc. of North Haven, Connecticut, $2.4 million**
  Advance a cost-effective power solution for space, military, and everyday applications on Earth. The solid oxide fuel cell stack will generate power directly from methane and oxygen propellants and other in-situ resources.

• **Sierra Nevada Corporation of Madison, Wisconsin, $2.4 million**
  Develop demonstration-scale hardware that uses methane and concentrated solar energy to extract oxygen from lunar regolith. The hardware could be tested on a commercial lunar lander to prove a full-scale production plant's viability using this process.

• **SSL Robotics (Maxar Technologies) of Pasadena, California, $8.7 million**
  Develop a lighter and less expensive robotic arm for lunar surface applications, in-orbit servicing, and terrestrial defense applications.

• **Teledyne Energy Systems of Hunt Valley, Maryland, $2.8 million**
  Advance a hydrogen electrical power system to enable a fuel cell with an operating lifetime of 10,000 hours. Teledyne will fly a test article of the water separator on a parabolic aircraft to characterize the effect of various gravities.

Closed-Loop Descent and Landing Capability Demonstration
Suborbital platforms can enable testing of integrated precision landing and hazard avoidance technologies, using lunar trajectories during descent and landing. NASA’s current investments in precision landing and hazard avoidance will benefit from analyzing flight data acquired through tests and missions in relevant environments, including those experienced during suborbital flights.

• **Masten, $10 million**
  Masten will demonstrate precision landing and hazard avoidance testing capabilities across relevant lunar trajectories. Masten will mature its Xogdor vehicle to provide researchers from government, academia, and industry with a new platform for testing space technologies.

For more information about the 2020 Tipping Point selections, visit:  
https://go.nasa.gov/3k02Frc

To learn more about NASA space tech public-private partnership opportunities, visit:  
https://go.nasa.gov/36NebCx
especially the way it went on and on. And me the fool, voting for Nixon because his Secretary of State said they would end the war; and instead let it go on for years, in part so he could get re-elected. And worse our generals and admirals were on their stairway to the stars and let it go on and on instead of retiring in protest. Not one retired in protest, the only reason an armed service needs four star generals or admirals. In retrospect, in war, all general officers should be frozen in rank until the end of hostilities and then only those who contributed should be promoted.

There is an everlasting mental baggage if you kill your own troops with your friendly fire. Would it be my bombs that would kill the friendlies in the middle of Hue? If it happened it would be clearly be my fault and my bombs; because there was little a back-seater could do but hold on and hope. Killing the innocent and the friendlies would have affected him and me the rest of our lives. We shared a once-in-a-lifetime that day, a bond, an experience that only deadly combat can fuse. I think back now as I write that for some reason there were no thoughts on my part at that time about killing the innocent or our own troops with my bombs. I found the truths about war over time, later in the missions ahead of me, but not then. That was not on my mind for a second - my only concern was to find the target and do my best to hit it.

We both listened carefully to the excited and concerned voices of the Marines and their forward air controllers pinned down on the ground in the city as they tried to talk me to the right building. The target was a small building in the middle of a city of small buildings. We both knew that the target was impossible to identify from the air by the descriptions given from ground level, most of the buildings had the same colors and the same roofs and they all looked alike. I don't remember one word from the back seat as we circled and looked. Most of the fine details of the mission are long forgotten. I do remember how hard and seriously I looked for that one building. I described the building and a small rice paddy nearby and they said I had the right target. Then I was faced with the next challenge, to hit that building. Why did I decide on the steepest dive angle, and why did I select all twelve bombs to release on one pass using the tightest bomb release interval possible on the weapons select panel? Was it an unconscious hedge? If I missed the target, there would be nothing left of the innocent or the friendlies to bury or to ship home in body bags. I do not know what made me make a small last second maneuver; "jinking" the bombsight pipper rapidly toward the small rice paddy about one hundred feet at the 4 o'clock position from the building. Some of it was a correction for a wind shear that was making the pipper drift.

It seems strange that I can still remember the shimmer off the brown water in that rice paddy as I dragged the pipper toward it. It seems now after some thought that it was all an almost subconscious act. The thought occurred to me after that mission, and many others, that I was not really trained or prepared properly for what I was doing on that day. Who would be held responsible besides me for killing with friendly fire? I clearly remember holding the dive run longer than necessary. I also remember holding down on the red round pickle button long after all the bombs were gone, until my right thumb hurt so bad, the pain told me to release. I remember the rapid succession of little thumps while in the steep dive. The thumps caused by the bomb release ejector racks firing almost instantaneously, releasing all twelve bombs. Their "smoke" drifted up from the streets and rooftops forming an irregular semicircle that helped me make the final and fateful decision. It also helped me judge the wind.

I finally selected the one building that I thought housed the heavy machine gun and mortar position that had them pinned down. I described the building and a small rice paddy nearby and they said I had the right target. Then I was faced with the next challenge, to hit that building. Why did I decide on the steepest dive angle, and why did I select all twelve bombs to release on one pass using the tightest bomb release interval possible on the weapons select panel? Was it an unconscious hedge? If I missed the target, there would be nothing left of the innocent or the friendlies to bury or to ship home in body bags. I do not know what made me make a small last second maneuver; "jinking" the bombsight pipper rapidly toward the small rice paddy about one hundred feet at the 4 o'clock position from the building. Some of it was a correction for a wind shear that was making the pipper drift.

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The Phantom and the Elephant (Continued from the Previous Page)

It was bombs away in a tight pattern, like a swarm of black hornets heading at a steep angle downward toward the middle of the city. I recall the wonderful feeling of release and the sensation of man-and-aircraft-as-one, after the jink, into a graceful pull off the bomb run into a beautiful arcing cloverleaf maneuver. A maneuver in full afterburner that had me for a moment looking straight up into a cool blue sky with small, bright, puffy white clouds. The Phantom and I were indeed one at that moment in time, one of my unforgettable moments: a feeling pilots know of and can fully enjoy. Then back to business, a hard G pull back to inverted flight to look over my left shoulder so I could see where the bombs hit. I paid no attention to the rapid loss of airspeed as I pulled up into an almost vertical recovery maneuver over the city. I had never seen that many bombs go off before.

But it was too late; all I could see was a huge growing cloud of dirty brown and black smoke, dust, dirt, parts and pieces rapidly tumbling and flying in all directions, billowing up from where all twelve bombs hit.

It is an everlasting image, three tons of bombs slamming into the city at over 500 knots. Bombs fused to go off deep in the ground exploded together throwing tons of dirt and thousands and thousands of pieces of debris into the sky then they rained down everywhere. What was once a building and the enemy was all part of a giant ugly brown billowing cloud. Many of the pieces were already hitting the nearby rice paddy making splashes like hail from a great Midwest thunderstorm.

The debris rained down on the city and splashed down in that pond of shiny brown water that was just a moment ago in the middle of my gun sight. I recovered from the inverted position without a thought or concern about the nose high altitude and low airspeed. We circled and there was a long uncomfortable silence on the radio.

It was as if all of us, those on the ground and in the air, all held our breath at the same time - an eerie silence. The giant dirt cloud finally settled and the verdict came in with a rebirth of the radios. The forward air controllers and radio operators talked to each other and to me with excited voices. All in a glorious confirmation, each voice confirming to me and to each other that they were still there, still alive.

As faith and luck and maybe some skill would have it, all twelve bombs, the first I ever dropped in combat, were right on target.

Only now does it occur to me that maybe a part of the excitement I heard in their voices was a relief. We all survived and they would not be sent home in body bags or with missing body parts. My OPS officer and I would not have to live with the nightmares of killing the friendly. In retrospect I think it was fate, somehow confidence, good luck, and a big relief. That long ago mission eventually faded into all the others. Some of the others were just as exciting, but none as rewarding.

Mostly there was the haunting reminder, during the early missions, that I really was not trained or prepared for what I was doing and there would be no time or person to train me in the middle of combat.

There is no substitute for being the best, and the cheerleader stuff we were exposed to was just that - cheerleader stuff - which is ok for football but no substitute for substance and performance. Some of our pilots are the best. And many more can be the best but only if demanded to be by our leadership. And that is where the fault lays, dear Brutus. For all of us to be the best we can be, our leaders must lead by example.

This story is dedicated to all those who wanted to be the best, but of whom it was never required.

About the Author:

Cornelius Neil Cosentino, retired USAF pilot, 6,000+ hours in fighters, bombers and tankers, commercial and private aircraft. Graduated from the University of Southern California Aerospace Safety management program, Aerospace Consultant in the Middle-east. Airline Transport Pilot, certified flight Instructor in multiengine, and instruments, rated in seaplanes, glides, and helicopters. Author, publisher, owned and operated Air Treasure Cay, an FAA Part 135 air taxi charter service; was engaged in tourism, cruise ship operations and hotel development in the Bahamas; currently CEO of FASTA Florida, a Tampa Bay based Air & Surface Transportation think tank developing a 1st Global airport, and the JRC aircraft for the National Interstate Flyways System (NIFS).
What would a China-US war look like? (Continued from Page 23)

China has less risky options. While Beijing has never attempted to invade Taiwan itself, it has a history of attacking islands that are under Taiwan’s control. It also has a losing record.

Likely candidates are Kinmen (Quemoy) and Penghu (Pescadores). Penghu has an airbase and has been busy fending off incursions of a variety of Chinese warplanes recently, suggesting that China is testing Penghu’s defenses. Kinmen has been more or less quiet, but it could be targeted. Again.

Between October 25 and 27, 1949, newly communist China launched an attack on Kinmen to try to defeat Chiang Kai-shek’s Republic of China (ROC) forces on the island. The 1949 Battle of Gumingtou was a sea invasion of Kinmen from the mainland, which is only 2 km away. The invasion failed after three days of heavy fighting. On July 26, 1950, on a lesser scale, China tried to take Dadan Island, part of the Kinmen island group, sending 700 soldiers into the attack, which failed. Starting in 1958, China launched a massive and lengthy artillery barrage, known as part of the Second Taiwan Strait Crisis. On August 24 and 25, China attempted to land on and take Donding Island but its forces were repulsed by Taiwan (ROC) forces.

An attack on Kinmen is potentially easier for China than an attack on Taiwan and, unless preempted before it gets underway, it is hard to see how an invasion could be stopped, although it would surely take time for China to subdue the island. While Kinmen is heavily fortified, the island lacks up-to-date defense systems.

On the other hand, its close proximity to the mainland limits the exposure of China’s invading force to Taiwanese or American air or naval counterattack.

In at least one US war game of a straight-on invasion of Taiwan, the players decided to walk away (other than using air power), evaluating a Chinese invasion of Taiwan as “not an existential threat.” That is unrealistic, considering the consequences for the US posture in East Asia under that circumstance. Chances are good that the entire US security infrastructure in the region would quickly unravel.

China’s objective in attacking Kinmen would be to force a change in Taiwan’s internal politics in Beijing’s favor. In that sense, politically, an attack on Kinmen is an attack on Taiwan. Taipei can’t surrender the islands, nor surrender the troops there, nor permit the 150,000 inhabitants to fall under China’s control. Washington would come under enormous pressure to intervene.

The Pentagon’s current war-gaming rests on three shaky presumptions: American weakness, Chinese strength and a direct Chinese attack on Taiwan. All three contribute to strategic uncertainty and increase the danger of military miscalculation.

About the Author: Stephen Bryen is a former senior Defense Department official and regular contributor to Asia Times. Shoshana Bryen is the senior director of the Jewish Policy Center in Washington, DC.
and SHREC are participants in the PGH Space Collaborative, a group seeking to coalesce a broader network of existing regional assets to revitalize Pittsburgh as a space robotics hub. The Astrobotic-SHREC partnership begins with a two-year-long agreement and will culminate in an enhanced UltraNav system in 2022.

Chris Owens, Astrobotic Research Engineer and Principal Investigator for the UltraNav project.

Pictured is the supercomputer Pitt sent to the International Space Station in 2019.

About Astrobotic
Astrobotic Technology, Inc. is a space robotics company making space accessible to the world. They develop advanced navigation, operation, and computing systems for spacecraft, and their fleet of lunar landers and rovers deliver payloads to the Moon for companies, governments, universities, non-profits, and individuals. The company has more than 50 prior and ongoing NASA and commercial technology contracts and a corporate sponsorship with DHL. Astrobotic was founded in 2007 and is headquartered in Pittsburgh, PA.

Alan George, SHREC Center Director and R&H Mickle Endowed Chair of Electrical and Computer Engineering at Pitt’s Swanson School of Engineering.
Limitless Space Institute announces inaugural Interstellar Initiative Grants awards

(Continued from Page 27)

Assessing the viability of vacuum-based propulsion with hydrodynamic quantum field theory (TACTICAL): Properties of the vacuum are probed from a new theoretical perspective inspired by a macroscopic pilot-wave system | John Bush, Massachusetts Institute of Technology
*SPACE DRIVE/PROPULSION; rapid human exploration of outer solar system, interstellar

Asymmetric Potential Vacuum Fluctuation Forces (TACTICAL): Generate propellantless propulsion forces from quantum vacuum fluctuations by engineering the direct interaction between nanostructure potentials and the vacuum | Charles Chase, UnLab, Washington, DC; Technion – Israel Institute of Technology
*SPACE DRIVE/PROPULSION; rapid human exploration of outer solar system, interstellar

Traversable Wormholes: A Road to Interstellar Exploration: Establish whether introducing modifications of the Casimir energy can produce a Traversable Wormhole (TW) of an appropriate size that could be used for interstellar travel | Remo Garattini, University of Bergamo, Italy
*WARP/WORMHOLE; rapid interstellar

Collaborations: The Breakthrough Initiatives organization has graciously agreed to cover the travel costs for PI participation, venue arrangement, and live webcasts for the Kickoff, Midterm, and Symposium meetings. Additionally, Texas A&M University Engineering Experiment Station (TEES) has graciously agreed to serve in the role of contract administration and enforcement for the grants, and will serve as the funding conduit through which LSI will administer the grant funds. LSI expresses its deep gratitude to Breakthrough Initiatives and TEES for leaning in with LSI to help conduct LSI's Interstellar Initiative Grants effort.

It is LSI's vision that by establishing the Interstellar Initiative Grants, and by conducting these grant awards on a biennial cycle, LSI will help grow and mature the capabilities of the interstellar research community, and make measured progress towards the goal of one day enabling interstellar flight.

…GO INCREDIBLY FAST…
NASA’s SpaceX Crew-1 Astronauts Headed to International Space Station

(Continued from Page 28)

The astronauts named the Crew Dragon spacecraft Resilience, highlighting the dedication teams involved with the mission have displayed and to demonstrate that when we work together, there is no limit to what we can achieve. They named it in honor of their families, colleagues, and fellow citizens.

“Watching this mission launch is a special moment for NASA and our SpaceX team,” said Steve Stich, manager of NASA’s Commercial Crew Program. “We are looking forward to getting this crew to station to continue our important work, and I want to thank the teams for the amazing effort to make the next generation of human space transportation possible.”

During flight, SpaceX commands the spacecraft from its mission control center in Hawthorne, California, and NASA teams monitor space station operations throughout the flight from the Mission Control Center at the agency’s Johnson Space Center in Houston.

Hopkins, Glover, Walker, and Noguchi will join the Expedition 64 crew of Commander Sergey Ryzhikov and Flight Engineer Sergey Kud-Sverchkov, both of the Russian space agency Roscosmos, and Flight Engineer Kate Rubins of NASA.

“It is an honor to have our Japanese astronaut launch on this Crew-1 Dragon as the first astronaut of the International Partner participating in the ISS program,” said Hiroshi Sasaki, JAXA vice president. “We look forward to having him conduct lots of science and demonstrate the technology, for here on Earth and for the future. I would also like to thank NASA and SpaceX for their tremendous effort to make this happen.”

Rubins, Hopkins, Glover, Walker, and Noguchi will participate in a live crew news conference from orbit at 9:55 a.m. Thursday, Nov. 19, on NASA TV and the agency’s website.

Crew-1 Astronauts

Michael Hopkins is commander of the Crew Dragon spacecraft and the Crew-1 mission. Hopkins is responsible for all phases of flight, from launch to re-entry. He also will serve as an Expedition 64 flight engineer aboard the station. Selected as a NASA astronaut in 2009, Hopkins spent 166 days in space as a long-duration crew member of Expeditions 37 and 38 and completed two spacewalks totaling 12 hours and 58 minutes. Born in Lebanon, Missouri, Hopkins grew up on a farm outside Richland, Missouri. He has a bachelor’s degree in aerospace engineering from the University of Illinois, and a master’s degree in aerospace engineering from Stanford University. Before joining NASA, Hopkins was a flight test engineer with the U.S. Air Force. Follow Hopkins on Twitter.

Victor Glover is the pilot of the Crew Dragon spacecraft and second-in-command for the mission. Glover is responsible for spacecraft systems and performance. He also will be a long-duration space station crew member. Selected as an astronaut in 2013, this is his first spaceflight.

The California native holds a Bachelor of Science degree in general engineering from California Polytechnic State University, a Master of Science degree in flight test engineering and a master’s degree military operational art and science from Air University, and a Master of Science degree in systems engineering from Naval Postgraduate School. Glover is a naval aviator and was a test pilot in the F/A-18 Hornet, Super Hornet, and EA-18G Growler aircraft. Follow Glover on Twitter and Instagram.

Shannon Walker is a mission specialist for Crew-1. As a mission specialist, she works closely with the commander and pilot to monitor the vehicle during the dynamic launch and re-entry phases of flight. She also is responsible for monitoring timelines, telemetry, and consumables. Once aboard the station, Walker will become a flight engineer for Expedition 64. Selected as a NASA astronaut in 2004, Walker launched to the International Space Station aboard the Russian Soyuz TMA-19 spacecraft as the co-pilot, and spent 161 days aboard the orbiting laboratory. More than 130 microgravity experiments were conducted during her stay in areas such as human research, biology, and materials science. A Houston native, Walker received a Bachelor of Arts degree in physics from Rice University, as well as a Master of Science degree and a doctorate in space physics, both from Rice University, in 1992 and 1993, respectively.

(Continued on the Next Page)
Soichi Noguchi also is a mission specialist for Crew-1, working with the commander and pilot to monitor the vehicle during the dynamic launch and re-entry phases of flight, and keeping watch on timelines, telemetry and consumables. Noguchi also will become a long-duration crew member aboard the space station. He was selected as an astronaut candidate by the National Space Development Agency of Japan (NASDA, currently the Japan Aerospace Exploration Agency) in May 1996. Noguchi is a veteran of two spaceflights. During STS-114 in 2005, Noguchi became the first Japanese astronaut to perform a spacewalk outside the space station. He performed a total of three spacewalks during the mission, accumulating 20 hours and 5 minutes of spacewalking time. He launched aboard a Soyuz spacecraft in 2009, to return to the station as a long-duration crew member. The Crew Dragon will be the third spacecraft Noguchi has flown to the orbiting laboratory. Follow Noguchi on Twitter and Instagram.

Mission Objectives

The crew will conduct science and maintenance during a six-month stay aboard the orbiting laboratory and will return in spring 2021. It is scheduled to be the longest human space mission launched from the United States. The Crew Dragon spacecraft is capable of staying in orbit for at least 210 days, as a NASA requirement.

Crew Dragon also is delivering more than 500 pounds of cargo, new science hardware and experiments inside, including Food Physiology, a study of the effects of an optimized diet on crew health and, Genes in Space-7, a student-designed experiment that aims to better understand how spaceflight affects brain function, enabling scientists to keep astronauts healthy as they prepare for long-duration missions in low-Earth orbit and beyond.

Among the science and research investigations the crew will support during its six-month mission are a study using chips with tissue that mimics the structure and function of human organs to understand the role of microgravity on human health and diseases and translate those findings to improve human health on Earth, growing radishes in different types of light and soils as part of ongoing efforts to produce food in space, and testing a new system to remove heat from NASA's next generation spacesuit, the Exploration Extravehicular Mobility Unit (xEMU).

During their stay on the orbiting laboratory, Crew-1 astronauts expect to see a range of uncrewed spacecraft including the next generation of SpaceX cargo Dragon spacecraft, the Northrop Grumman Cygnus, and the Boeing CST-100 Starliner on its uncrewed flight test to the station. They also will conduct a variety of spacewalks and welcome crews of the Russian Soyuz vehicle and the next SpaceX Crew Dragon in 2021.

At the conclusion of the mission, the Crew-1 astronauts will board Crew Dragon, which will then autonomously undock, depart the space station, and re-enter Earth’s atmosphere. Crew Dragon also will return to Earth important and time-sensitive research. NASA and SpaceX are capable of supporting seven splashdown sites located off Florida's east coast and in the Gulf of Mexico. Upon splashdown, the SpaceX recovery ship will pick up the crew and return to shore.

NASA’s Commercial Crew Program is delivering on its goal of safe, reliable, and cost-effective transportation to and from the International Space Station from the United States through a partnership with American private industry. This partnership is changing the arc of human spaceflight history by opening access to low-Earth orbit and the International Space Station to more people, more science, and more commercial opportunities.

The space station remains the springboard to NASA's next great leap in space exploration, including future missions to the Moon and, eventually, to Mars. For more than 20 years, humans have lived and worked continuously aboard the International Space Station, advancing scientific knowledge and demonstrating new technologies, making research breakthroughs not possible on Earth. As a global endeavor, 242 people from 19 countries have visited the unique microgravity laboratory that has hosted more than 3,000 research and educational investigations from researchers in 108 countries and areas.

Learn more about NASA’s Commercial Crew program at:

https://www.nasa.gov/commercialcrew
“Who are they?” Gallery 1/2 – Michelle Evans

X-15 Personnel - A photo commemorating all three X-15's being flown during the same week.

(Please see the descriptions in the next page)
For anyone who worked at North American Aviation, or at the NASA Flight Research Center at Edwards AFB, during the time of the X-15 rocket plane program, I am looking for assistance in helping to identify as many people as I can. I have many photos on my web site showing people that I would like to give credit to if possible, so any help anyone at the AIAA can be in these identifications, would be greatly appreciated. There are photographs throughout my web site concerning the X-15, but the two primary pages I am requesting assistance on are the following:

North American Aviation X-15 Personnel:
http://www.mach25media.com/personnel.html

and NASA/USAF X-15 Personnel"
http://www.mach25media.com/naa.html

Feel free to look through any other pages on the site as well in case there might be others you know. There is a link to the "X-15 Index" page on all the pages associated with the X-15. It is there that you'll see links to all X-15 pages. Also you are free to share the links with anyone else who you think might be of assistance. If you can identify anyone, please mention the page title, then identify the photo by if it is in the left or right column, and which photo down from the top of the page it is within that column. Please contact me via at Michelle Evans <mach25@sbcglobal.net>.

Thank you for any assistance in helping to identify these people in aerospace history.
RSVP and Information:  [https://conta.cc/3kLO8iR](https://conta.cc/3kLO8iR)

**Saturday, November 21, 2020, 10 AM PST (Add to Calendar)**

**AIAA LA-LV e-Town Hall Meeting 11/21**

**(Part I) Interstellar Flight Environments and Effects**

by

**Dr. Henry B. Garrett**

AIAA Fellow

Principal Scientist

OFFICE OF SAFETY AND MISSION SUCCESS

Jet Propulsion Laboratory

----------------------------------------------------------------------

**(Part II) Boeing EA-18G Growler**

by

**Lynn Jenson**

Project Manager, F/A-18 & F-5 Programs

Northrop Grumman | Aeronautics Systems

Tentative Agenda (All Time PST) (Pacific Standard Time, US and Canada)

10:05 am (PST): Dr. Chandrashekhar Sonwane (Welcome, AIAA LA LV Section Chair)
10:10 am (PST): Dr. Henry B. Garrett (JPL)
11:40 am (PST): Mr. Lynn Jenson (Northrop Grumman Aeronautics Systems)
01:10 pm (PST): Adjourn

Questions about Events/Program:  events.aiaalalv@gmail.com
Volunteers are needed for all AIAA activities, please contact: cgsonwane@gmail.com

RSVP and Information: https://conta.cc/34Uvgt3
Saturday, December 5, 2020, 10 AM PST (Add to Calendar)

AIAA LA-LV e-Town Hall Meeting 12/5

(Part I) Digitalization - the Crucial Advantage for the Modern Aerospace Program
by
Mr. Dale Tutt, Vice President,
Aerospace and Defense Industry
Siemens Digital Industries Software (DISW)

(Part II) Does art really have its place in the space mission design?
Mars City Urban Farming Design Winners 2020
by
Ms. Vera Mulyani
CEO, Founder and the lead "Marschitect"
Mars City Design

Tentative Agenda (All Time PST) (Pacific Standard Time, US and Canada)

10:05 am (PST): Dr. Chandrashekhar Sonwane (Welcome)
10:10 am (PST): Mr. Dale Tutt (Siemens)
11:40 am (PST): Ms. Vera Mulyani (Mars City Design)
01:10 pm (PST): Adjourn

Questions about Events/Program: events.ajaalalv@gmail.com
Volunteers are needed for all AIAA activities, please contact: cgsonwane@gmail.com

Saturday, December 12, 2020, 10 AM PST (Add to Calendar)

AIAA LA-LV e-Town Hall Meeting 12/12

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

Exploring Solar System / Mars through Low-Latency Telepresence (LLT)
by
Daniel R. Adamo
Independent Aerodynamics Consultant, NASA JSC - Retired
AIAA Distinguished Lecturer
AIAA Associate Fellow

RSVP and Information: https://conta.cc/3d9wDGD
Questions about Events/Program: events.aiaalalv@gmail.com

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engage.aiaa.org/losangeles-lasvegas
Volunteers are needed for all AIAA activities, please contact: cgsonwane@gmail.com

Saturday, December 19, 2020, 10 AM PST (Add to Calendar)

AIAA Los Angeles-Las Vegas Section
Christmas Holiday Special Event
Saturday, December 19th, 2020 (online on Zoom)
10 am-2:00 pm (PST) (Add to Calendar)
RSVP and Information: https://conta.cc/38UVePz

A Space Architecture Gathering
moderated by Prof. Madhu Thangavelu
USC Astronautical Engineering Department and USC School of Architecture

This event will have two parts. First segment will focus on Extraterrestrial Habitat Simulators and Simulations. Experiences of “Simnauts” during the course of their simulated and choreographed expedition are presented. Activities and divergence from planned program will be addressed. The second part will bring together an international group of space architects who will present their latest and greatest visions for our Moon, Mars and beyond. Each part will be concluded by a panel followed by discussion and Q&A from audience.

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Part 1. Invited participants in Simulators and Simulations program include:
Prof. Bernard Foing – Advanced Projects, European Space Agency
Dr. Susmita Mohanty – ETO
Mr. Rob Mueller – NASA KSC
Dr. Michaela Musilova – HISEAS Hawaii
Dr. Pascal Lee – Mars Institute
Mr. Henk Rogers – Chairman PISCES, Founder International MoonBase Alliance
Dr. Robert Zubrin – Mars Desert Research Station

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Part 2. Invited international participants in the Space Architecture program include:
Mr. Samer El-Sayary – Alexandra University Egypt
Mr. Anthony Longman – SkyFrame Research
Prof. Sandra Häuplik-Meusburger - Vienna University of Technology
Ms. Vera Mulyani – Mars City Design
Dr. Tom Spilker & Mr. John Blincow – Gateway Foundation
Mr. Tomas Rousek – XTEND Architects, London
Mr. Thomas Schmidt – SepiaDesigns, Hong Kong

..awaiting RSVP from several more speakers / panelists

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

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

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

Victor Lewis Cook
MBAA/MAAS/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

Mike Wallace
Raytheon

(+a Civilian Airman To Be Announced)

(More TBA)

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