

February 2020

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Electronic Parts in the New Space Paradigm: Speaker: Dr. Jonathan "Jonny" Pellish (NASA Goddard) (9 December, 2019: Tackling Radiation Effects and Other Reliability Threats for Advanced Technologies)

by Karen Grothe, HRL Laboratories

and Packing Program
 NASA Office of Safety
 Center
 Community peers



Dr. Jonathan "Jonny" Pellish on Space Electronics. (Photo courtesy of Ken Lui)

The frontiers for space missions have changed. Cost constraints and cost "effectiveness" concerns have led to a shift away from large-scale missions, like the Hubble Space Telescope. As a result, two trends have emerged: commercial space ventures and small missions like CubeSats and constellations. These trends are driving the use of non-traditional electronic parts types such as those used in the automotive industry. In addition, "architectural reliability" (e.g., resilience) has become desirable. Dr. Jonathan "Jonny" Pellish, Electronics Parts Manager in the Engineering and Technology Directorate at NASA Goddard Space Flight Center and the

deputy manager for the NASA Electronic Parts and Packaging (NEPP) Program gave the AIAA LA-LV Chapter an overview of these trends at an event on December 9, 2019, at the El Segundo Public Library.

Electrical, electronic, electromechanical, and electro-optical (EEEE) parts are available in "grades" which are designed, certified, qualified, and/or tested to meet specific environmental characteristics. Aerospace, automotive, industrial, medical, and space-enhanced product are some examples of grades. Commercial off the shelf (COTS) parts are a subset of these grades. Aerospace Grade is the traditional choice for space use, but there are relatively few available parts to choose from and their performance lags behind commercial counterparts with more constraints on size, weight, and power (SWaP). These parts are usually designed and tested for performance in a radiation environment and for reliability.

(continued on Page 10)

(More photos on bit.ly/3bIZErK, bit.ly/2uOtlXF, bit.ly/2SR1eR5)

Young Professionals Wine & Cheese Christmas Mixer (16 December, 2019)

by Tai Thai, Systems Engineer, Raytheon Space and Airborne Systems



Raffle winners with Council Members. Left: Dr. Dennis Wonica (Enterprise Chair), the 4th from Left: Dr. Seth Potter (Ambassador), Right: Moises Seraphin (YP Chair) (Photo courtesy of Dennis Wonica)

As the Holiday Season approaches, the AIAA Los Angeles - Las Vegas Section organized an exciting Wine & Cheese Christmas Mixer on December 16th, 2019. Taking place at the Automotive Driving Museum, the event was a huge success for both the chapter and the attendees.

With the wine, cheese, and vintage cars, it would be hard to find a better setting for people to network and enjoy each other's company. Attended by many young professionals who work in the aerospace industry and outside of it, as well as seasoned AIAA members, the event offered everyone opportunities to learn more about the aerospace industry, establish meaningful connections, and have a great time before the holidays. A wide selection of wines and cheeses were brought to the events by attendees and helped create a friendly and warm atmosphere. The Automotive Driving Museum also offers many rare and charming cars that until now I had only seen in pictures. Personally, I was fascinated by the people I met from other aerospace companies in the area like Boeing, the Aerospace Corporation, SpaceX, and Northrop Grumman, as well as my fellow Raytheon

employees whom I did not know until the event. It was great to discuss about their experiences and all the interesting projects (unclassified only) that they've worked on. I also met a young professional who started his own startup in Cyber Security and was impressed by his story of getting fundings, meeting investors, and finding projects. In addition, there was a raffle drawing with interesting prizes that certainly brought the lucky winners happy smiles and capped off the event on a high note.

The event was one of my favorite AIAA events in 2019 and the perfect way to end a great year for the organization. It brought together a group of very interesting people in a great setting within the heart of the Aerospace Industry itself - El Segundo. And even though I did not win the raffle, I won some wonderful memories, great connections, and fascinating conversations.



Attendees enjoying wine, cheese, and vintage car displays. (Photo courtesy of Dennis Wonica)

The Author: Tai Thai (Systems Engineer, Raytheon Space and Airborne Systems) works in the Assembly, Integration, and Test (AI&T) group and is a member of the Rotational Engineering Leadership Development Program (RELDLP). He graduated from Rensselaer Polytechnic Institute (RPI) with a B.S. (2017) and a M.S. (2018) in Aerospace Engineering. He enjoys things that fly, skiing, and road trips.

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January's Professionals Networking Mixer Event

by Mallorie Vanghel & Marilyn McPoland, Council Members of the AIAA LA LV Section



Attendees networking together and viewing the great aviation collections and inspiring development history of Douglas Aircraft in the Museum. (Photo courtesy of Ken Lui)

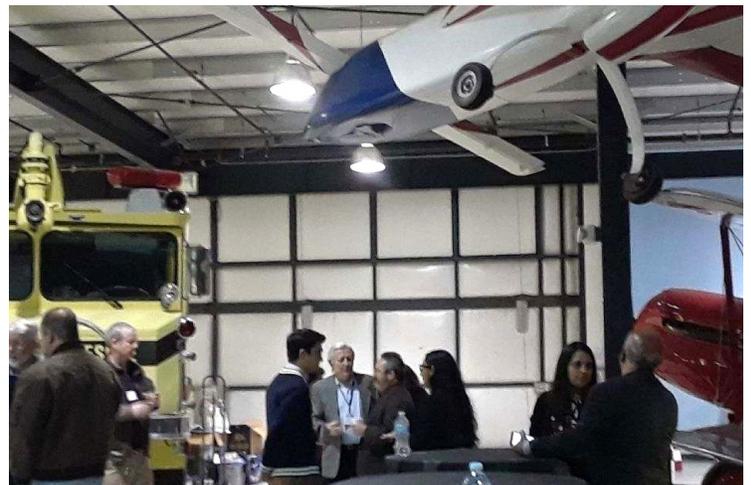
The monthly Professionals Networking Event for AIAA's Los Angeles-Las Vegas section, was held the evening of Monday January 13th, 2020 at the Museum of Flying in beautiful Santa Monica, CA. We were impressed with the great attendance to kick off the New Year! Many new professionals, long time members, and recently graduated students were welcomed and encouraged to network and make connections. A handful of kids came to enjoy the event, and were greeted with AIAA paper airplanes!

The smartly chosen venue to host the private event is nestled between the famous Santa Monica Airport, Barker Hangar, and Spitfire Grill. Neighboring runways created an appropriate atmosphere to get everyone in the mood for "flight." Upon entering the building, you couldn't miss the sparkling airplanes that have been polished and preserved to perfect display condition. Onlookers are overcome with admiration while marveling at the proud planes and art. An aerospace influence is present in the museum, as you will see space shuttle models and tributes amid the exhibits.

About halfway through the event, we heard from a few speakers, including museum volunteer Steve and teacher Monica Maynard. Steve gave insight to the museum guests and how they love visiting! He was happy to share that the museum attracts visitors of all ages, and he loves seeing kids interested in aviation. Monica followed by telling her story of wanting to be an engineer and finding her way into education. She spoke on her passion of being a Science Teacher and her enthusiasm for nurturing students to love science.

AIAA LA-LV council member, Marilyn McPoland, aviation and aerospace enthusiast, and the former Director of Programs for the Museum of Flying, was in attendance. She had previously shared highlights of her 20-year aviation career background in the AIAA Los Angeles-Las Vegas Member Spotlight, Nov. 25th 2019 edition.

The Santa Monica Airport (KSMO) was originally established during WWI, and later became home to the Douglas Aircraft where, among other aircraft, the entire line of DC reciprocating-powered-engine airliners was built. During WWII, the airport was cleverly disguised from the air as a "town" to protect the assets of Douglas Aircraft from possible enemy attack.



Attendees enjoying networking and aviation collections in the Museum. (Photo courtesy of Mallorie Vanghel)

When the Museum of Flying was first established on the North side of the airfield, it was founded on the premise of preserving historical artifacts and history of the Douglas Aircraft Company. Today it is home to 22,000 sq.ft. of aviation and aerospace assets, and continues to showcase the history of the Douglas Aircraft Company as evidenced by the Douglas DC-3 monument on display in front of the building. Other assets include Donald Douglas's original drafting table, as well as the original boardroom round conference table complete with a very "James Bond" looking world globe that sits in the center. Donald Douglas' personal leather-bound chair still holds its place of honor at that table. *(continued on Page 11)*

(More photos on bit.ly/2SLNh5q)

AIAA LA-LV 1/30 Dinner Meeting, featuring "In the Line of Duty: Michael Adams and the X-15" by Michelle Evans (30 January, 2020)

by Drew Miller, Lead Mechanical Design Engineer at Space Exploration Technologies Corporation (SpaceX)



Author and speaker Michelle Evans speaking about the amazing X-15 program at an AIAA dinner event at The Proud Bird. (Photo courtesy of Ken Lui)

The local LA AIAA members were treated to an incredible experience during a recent dinner meeting at the Proud Bird. Michelle Evans, the speaker for the event, presented a very comprehensive history of the X-15 hypersonic experimental research aircraft, providing incredible insight into the program, the legendary test pilots, and technical attributes of the aircraft and its operation. Michelle is the author of *The X-15 Rocket Plane, Flying the First Wings into Space*, which is one of the best, most in-depth written accounts of X-15, the research and the people associated with this record-breaking aircraft. Through her research required to write the book, she conducted dozens of interviews with members of the team, including pilots, engineers, technicians, and family members of pilots. This makes her one of the most knowledgeable living people about the X-15 program, and her presentation showed this. She covered the X-15 program and focused on Michael Adams, who was an amazing pilot (as well as father and husband) and the only pilot who lost his life on while flying the X-15. He also crossed the boundary of space during his fatal mission, making him the first American to perish during a space mission. Michelle covered Adams' life, mission, and death with great care, detail, and respect, and showed how the lessons learned from his fatal mission led to safer later X-15 missions as well as following Space Shuttle design and operation, which was heavily influenced by the X-15 program. The program itself was incredibly successful and unique in aerospace history, with 199 flights by 12 different pilots from the late 1950s to 1968. Michelle shared great stories

of the pilots of the program, including moonwalker Neil Armstrong, future Shuttle pilot (and last living X-15 pilot) Joe Engle, Bob Rushworth, and Joe Walker, among others. Some of these shared stories showed just how hilarious and tight-knit the pilots, engineers, and technicians were within the program, and that the program was cutting edge and methodical. Michelle's technical knowledge of each of the three X-15 airframes was very deep, and she clearly enjoyed sharing it with other like-minded aerospace fans. During her presentation, she showed photos that I (as a life-long X-15 fan) had never seen before, which was an absolute treat.



Attendees viewing the exhibited items related to Michael Adams and the X-15, brought by the Speaker. (Photo courtesy of Ken Lui)

At the conclusion of her presentation, she opened up to questions from the floor, which really drove home how much passion went into the research for the X-15 book and how important it is to share the achievements of the program for future generations to preserve it. After the presentation and Q&A, I had the opportunity to speak with Michelle about the X-15 program, the book, her experiences researching the book, as well as the current state of manned spaceflight. She signed my personal copy of her book, which means a tremendous amount to me and something that I hope to keep and lend out to other aerospace nuts as recommended reading. By hearing Michelle speak and seeing her presentation, I know that myself, the other AIAA members in attendance, and guests gained a huge appreciation for the X-15 program, Michael Adams work and sacrifice, as well as reinforce how important it is to learn and spread the learnings of past aerospace successes and failures.

(Continued on Page 12)

(More photos on bit.ly/2HqqLtt)

JANUARY 30, 2020: IN THE LINE OF DUTY: MICHAEL ADAMS AND THE X-15

by Mingyi Chen, Mechanical Design Engineer at ProCustom Group



Michelle Evans (left) speaking to enthusiastic attendees. (Photo courtesy of Ken Lui)



Attendees completely absorbed in and fascinated / inspired by the great stories and presentation. (Photo courtesy of Ken Lui)

Industry leaders, myself not included, and aerospace fanatics gathered at the Proud Bird in the heart of El Segundo with planes taking off and landing in the background from LAX to hear about two often overlooked supersonic heroes: Michael Adams and the X-15.

The one to bring Michael Adams and the X-15 rocket plane to life was none other than Michelle Evans who, in writing her bestseller, interviewed nearly 70 people connected to our two heroes. Michelle Evans is the founder and president of Mach 25 Media (www.Mach25Media.com). As a writer, photo courtesier, and communications specialist in aerospace, she continues to educate and inspire the public on space exploration, aerospace, and the courage to venture into the unknown. Her book “The X-15 Rocket Plane, Flying the First Wings into Space”, a finalist for the Eugene M. Emme Award for Astronautical Literature, exemplifies her mission to celebrate aerospace achievements and educate the public. Michelle has a background in missile systems with the Air Force and environmental testing for aerospace systems in private industry. She has appeared in numerous publications and was recognized as one of the 100 Most Influential People in Orange County.

While the space shuttle program is well-known and serves as a symbol of ingenuity, courage, and national pride, the less popular X-15 rocket plane was the first manned craft to reach hypersonic velocities. This plane, less of a rocket than a real rocket, helped usher in the concept that it was possible to descend from space in a

winged aircraft and safely land on the ground. Mike Adams, the last test pilot of the X-15, tragically lost his life in flight. Although today, few people know of his name compared to legendary pilots such as Scott Crossfield, Joe Walker, and Neil Armstrong, Michael gave his life to force the US government and authorities involved to re-examine the almost complacent culture of the space programs.

Michelle began the story of Michael Adams with much humor, introducing his early life in Sacramento. After graduating from Sacramento Junior College, he enlisted in the Air Force and served in the Korean War. After his service, “it seemed as if each time he changed schools, a new family member came aboard”, Michelle observed. He and wife Freida Adams had a total of 3 children during his studies at University of Oklahoma, MIT, and USAF Test Pilot School.

Of course, not all heroes had a smooth career. Michelle dove into Mike Adams’ phase of career disappointments before the X-15 program. While Adams was just as gifted and talented of a pilot as Neil Armstrong, he was not selected for the Apollo mission due to an injury he suffered during flight tests. After recovery, Adams found new hope in the USAF Manned Orbiting Laboratory program.

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(More photos on bit.ly/2HqgLtt)

JOBY AVIATION RAISES \$590 MILLION IN SERIES C FINANCING TO LAUNCH AIR TAXI SERVICE Toyota Motor Corporation Leads the Investment Round with \$394 Million Investment

Special Permission by Joby Aviation

Santa Cruz, CA, January 15, 2020 – Joby Aviation, a pioneer in the development of an electric air taxi, has raised \$590 million in Series C funding led by Toyota Motor Corporation. Prior investors, including SPARX Group, Intel Capital, Capricorn Investment Group, JetBlue Technology Ventures, Toyota AI Ventures, and AME Cloud Ventures, also contributed to the round, and were joined by new investors Baillie Gifford and Global Oryx (ALJ family’s investment arm). Shigeki Tomoyama, the Executive Vice President of Toyota Motor Corporation, will join Joby Aviation’s board of directors. This new investment brings the Company’s total funding, including previous rounds, to \$720 million.

Joby Aviation’s mission is to bring fast, affordable, and zero-emissions air mobility to communities worldwide. Over the past 10 years, the Company’s team of engineers and physicists has developed a quiet, all-electric VTOL (vertical take-off and landing) aircraft, which will be instrumental in the commercial launch of the emerging on-demand urban air taxi market. Toyota will share its expertise in manufacturing, quality, and cost controls to support the development and production of Joby Aviation’s aircraft. This support, along with the capital investment, will accelerate the certification and deployment of this new mode of local transportation.

“We are building a new system for transportation to transform your daily life, at greater safety and, in time, at a similar cost to driving,” said Joby Aviation founder and CEO JoeBen Bevirt. “This collaboration with Toyota represents an unprecedented commitment of money and resources for us and this new industry from one of the world’s leading automakers. Toyota is known globally for the quality and reliability of their products driven by meticulous attention to detail and manufacturing processes. I am excited to harness Toyota’s engineering and manufacturing prowess helping to drive us to achieve our dream of saving a billion people an hour a day.”

“Air transportation has been a long-term goal for Toyota, and while we continue our work in the automobile business, this agreement sets our sights to the sky,” said Toyota President and CEO Akio Toyoda. “As we take up the challenge of air transportation together with Joby, an innovator in the emerging eVTOL space, we tap the

potential to revolutionize future transportation and life. Through this new and exciting endeavor, we hope to deliver freedom of movement and enjoyment to customers everywhere, on land, and now, in the sky.”



About the aircraft: Joby Aviation’s aircraft is designed for 4 passengers plus a pilot. It can travel more than 150 miles on a single charge, is 100 times quieter than conventional aircraft during takeoff and landing, and is near-silent in flyover.

- **Aircraft type:** Piloted, all-electric vertical take-off and landing (eVTOL) air taxi
- **Source of power:** All-electric, zero emissions
- **Capacity:** Designed for four passengers plus a pilot
- **Sound:** The aircraft is 100 times quieter than conventional aircraft during takeoff and landing, and near-silent when flying overhead.
- **Range:** The aircraft is capable of speeds of 200 miles per hour and can fly over 150 miles on a single charge.
- **Cost:** The aircraft will be operated as a service with per-trip passenger pricing. Over time, that price should approach the cost of ground transportation.
- **Redundancy:** High levels of redundancy designed into the aircraft enhance safety and reliability.

About Joby Aviation

Joby Aviation is a California based aerospace company that is developing and commercializing all-electric vertical takeoff and landing aircraft (designated by the FAA as the S4) to enable the deployment of fast, quiet and affordable air taxi services. The Company’s mission is to get people to their destination five times faster than driving, reduce urban congestion, and accelerate the shift to sustainable modes of transit. Founded in 2009, Joby pioneered the development of eVTOL aircraft and has offices in Santa Cruz, San Carlos and Marina, CA. You can find more information at www.jobyaviation.com.

(Special) Inner Telescope, a Space Artwork by Eduardo Kac A film by Virgile Novarina, production : Observatoire de l'Espace du CNES

by Joris Bossard (with Special Permission)



Thomas Pesquet and Inner Telescope in the International Space Station. ©ESA, CNES, Eduardo Kac, Virgile Novarina

During his scientific mission involving some sixty experiments, astronaut Thomas Pesquet also created the first artistic performance in space specially designed for weightlessness: a work created by the artist Eduardo Kac. A film by Virgile Novarina retraces this spatial and poetic adventure.

For the past ten years, the American artist Eduardo Kac has been wondering what specific art forms could exist in space, without transposing a work of art created on Earth: What new artistic and poetic experiences could weightlessness allow? His reflections led him to create a three-dimensional shape, having neither top nor bottom, and carrying many different meanings depending on the angle at which it is seen. A work designed to float in space with its spectator, also in weightlessness...

This approach immediately seduced the French astronaut Thomas Pesquet, who agreed to carry out this artistic experience during his six-month stay aboard the International Space Station. A film by Virgile Novarina entitled "Inner Telescope, a Space Work by Eduardo Kac" (35', Space Observatory) retraces this whole adventure, from Eduardo Kac's workshop in Chicago to the Columbus module of the International Space Station, including the astronaut training centre in Cologne, Germany, and the Baikonur cosmodrome in Kazakhstan.

Previously, works of art had already been brought into the Space, but this time it was a question of creating a new work on board the International Space Station, a

work that only makes sense in this very special environment. Made of very simple materials available on board the station, "Inner Telescope" consists of a cutting and assembly of two sheets of paper, which float to symbolize a small orbital station, a telescope, a character with a cut umbilical cord, and the word "MOI", representing the "I" of humanity freed from gravity. This is a multi-faceted work with a great poetic force from the moment Thomas Pesquet drops it in front of the camera and flies with it to the famous Cupola: the privileged place to observe the Earth.



The artist Eduardo Kac and the astronaut Thomas Pesquet at the European Astronaut Center in Germany. ©Virgile Novarina, ESA, CNES



Inner Telescope in the International Space Station. ©ESA, CNES, Eduardo Kac, Virgile Novarina

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(Special) Artemis: MAXIM Mission Tribute to Apollo: Team Project 2019 USC ASTE 527: Space Exploration Architectures Concept Synthesis Studio Madhu Thangavelu, Conductor (17 December, 2019)

by Madhu Thangavelu (arranged by Ken Lui)



Prof. Madhu Thangavelu making opening remarks. (Photo courtesy of Ken Lui)

The 2019 USC ARTEMIS Project chose to pay tribute to a unique group of high-achieving engineers and scientists and explorers who created and executed the Apollo program with daring and precision. They went on to repeat the feat over and over, even succeeding in the face of peril. In the process, inspired the awe of the whole world while paving the way to making us a truly spacefaring species.

This year, on the 50th anniversary of the historic Apollo 11 Moon landing, the studio chose to look for fresh, new ideas that support policy, while drawing attention to new and age-old customs and sensitivities with which our species seem to resonate that were not within the traditional boundaries of the scientific and engineering communities until recently. As scientific and engineering methods are employed to better appreciate and shape outcomes of those soft, anthropological, social, cultural and behavioral science disciplines, human spaceflight could pioneer the use of these values and tools to promote developments in other, harder, technological arenas of endeavor as well. At USC, we call this Engineering+.

Great civilizations and cultures of the world actively seek to preserve and protect their heritage. Preserving human space culture, especially the first excursions of our species to an extraterrestrial surface, is very important for our youthful nation. Preserving human space culture is important for all humanity who cherish and yearn for freedom of thought and expression around the world,

since the vastness and resources of outer space present the ultimate arena for it. As a step toward that goal, this USC ARTEMIS Project chose to examine, study and deploy methods to protect lunar sites visited by Apollo astronauts, and to preserve Apollo artifacts on our Moon, from natural degradation, and to protect them from present and future artificial agents, for posterity.

The USC ARTEMIS Project chose to present a case to do this quickly, by the 50th anniversary of the last human to visit the Moon, starting the mission by 2022 and concluding by 2024 at latest, as mandated by the administration. The Apollo type equatorial free-return mission profile was selected for a seven Earth-day daylight lunar surface traverse mission. A daylight rover traverse mission on mare terrain offers several safety advantages over a polar mission, especially for the first few lunar visits, five decades after Apollo. Such human lunar surface activity would remind all about US preeminence in human space activity, make maximum impact on national space policy and help further strengthen a global coalition to engage in peaceful, progressive, cooperative and collaborative human space activity.



Prof. Madhu Thangavelu moderating the Q&A session after the students' presentations. (Photo courtesy of Ken Lui)

Slides from Fall 2019 USC ARTEMIS: MAXIM project finals were just posted.

sites.google.com/a/usc.edu/aste527/home

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AIAA Los Angeles-Las Vegas Presentation Summary: (25 January, 2020) Sierra Nevada Corporation Propulsion Division: Presenter: Mike Carkin

by William Kelly, Council Member, AIAA Los Angeles-Las Vegas Section (Author's bio in the December '19 Newsletter)



On January 25th, the Michelle Obama Library in Long Beach, CA was the scene of an excellent presentation on the Sierra Nevada Corporation (SNC), its diverse product lines and the unique rocket propulsion technology being developed there. SNC is an American privately held electronic systems provider and systems integrator specializing in [microsatellites](#), [telemedicine](#), and commercial orbital transportation services (www.theladders.com/company/sncorp-jobs). The company contracts with the [United States Armed Forces](#), [NASA](#) and [private spaceflight](#) companies. SNC has 34 locations in 19 U.S. states, England, Germany and Turkey.



On February 1, 2010, SNC was awarded \$20 million in seed money in phase 1 of NASA's [Commercial Crew Development \(CCDev\)](#) program for the development of the Dream

Chaser. Of the \$50 million awarded in the phase 1 CCDev program, [Dream Chaser's](#) award represents the largest share of the funds.

The presentation was made by Mr. Mike Carkin, a lead propulsion engineer who works for Orbitec, a wholly owned subsidiary of SNC located in Madison, Wisconsin. Orbitec started up in 1988 on SBIR funding in the basement of one of the founders and the back alley of a local bank in downtown Madison. Mike is also the Chairman of the Wisconsin section of the AIAA.

In addition to Orbitec, SNC has acquired numerous other small companies which have generated government contracts for electronic warfare, aircraft navigation and guidance, remote monitoring and cyber security. Orbitec has a history of moderate-power liquid and hybrid rocket engine development. It also provides human life support systems and space propulsion systems including gelled propellant, telerobotics and sensors. Other Orbitec products include lunar and Martian soil simulants and oxygen generators using lunar regolith.

Perhaps the most popular section of the presentation for the assembled crowd of old and young rocket scientists was the section on vortex flow rocket engine combustion. Liquid propellant combustion chambers using this technology inject fuel and/or oxidizer tangentially along the chamber wall. Tests have shown that this architecture provides high combustion efficiency, adequate chamber wall cooling and remarkable combustion stability. The low heat load can decrease soak back temperatures to engine sensors and valves, improve low cycle fatigue life, eliminate combustion chamber cooling channels and avoid the need for exotic materials in joints and welds. Mike predicts an unmanned Dream Chaser will launch sometime in 2021 using vortex flow thrusters on some (or all?) of the required rocket propulsion applications. The engines will be reusable and use green propellants that are non-hypergolic.



Students from the AIAA Cal Poly Pomona Student Branch and the Norco College networking with Mike. (Photo courtesy of Ken Lui)

Numerous students surrounded Mike after the presentation to pick his brain with questions about propulsion technology. Perhaps we can get Mike to come back for a celebration after Dream Chaser launches.



Students from the Norco College Rocket Team volunteering in the event with the AIAA LA-LV Section. (Photo courtesy of Ken Lui)

(More photos on: bit.ly/2UZBdAo, bit.ly/3bOdc50)

Electronic Parts in the New Space Paradigm *(continued from Page 1)* **Speaker: Dr. Jonathan “Jonny” Pellish (NASA Goddard)**



Attendees listening to the exciting presentation and engaging / networking interactively with the speaker and fellow attendees. (Photo courtesy of Ken Lui)

From a space user’s perspective, COTS components are parts not explicitly designed for space applications, such as automotive, consumer, industrial, medical, or terrestrial military grade EEEE parts. NASA has been using COTS components as parts in some systems, such as on the GOES-R geostationary weather satellites, and also in some mostly COTS systems, such as the NASA GSFC Dellinger CubeSat which was released to orbit from the ISS. Another exciting example of a system made up of mostly COTS that is coming up is the Mars Helicopter, about which Dr. Pellish shared a video.

“New Space” refers to the rise of SmallSats, constellations, and swarms along with the rise of commercial space companies like SpaceX. These trends have led to a merging of component grades. Risk acceptance is being used as a means to enable innovation. Up until the early 1990s, NASA only used COTS parts when there was no military/aerospace option to fulfill requirements – or in non-critical applications. Key performance requirements (e.g., SWaP) drove COTS parts into the mainstream. The classic approach used for deploying COTS electronics in flight systems is called “upscreening”: perform a series of tests over extended parameters (temperature, vacuum, radiation, shock, vibration, etc.), coupled with application information, to determine if a part can meet a mission’s reliability and availability requirements. The use of COTS components is evolving, however, as many newer systems using COTS parts see schedule becoming more critical, budgets being limited, and SWaP being limited. Performance or availability may have been the only

reasons for the COTS parts selection. If it’s not possible to qualify by analysis, that leaves testing, but surprisingly, higher risk tolerance does not always equal lower qualification budget.

The space environment is an important consideration when deciding what COTS parts to use. New Space requires a hybrid of radiation-hardened components and pure COTS parts. Parts must be able to reasonably withstand space weather and space climate, the natural space radiation environment (galactic cosmic rays, solar protons, and heavy ions, as well as neutrons and gamma rays from background or radioisotope sources on deep-space missions), and possible really big events from the sun (such as coronal mass ejections). Single-Event Effects (SEE) are real – a single energetic particle passing through spacecraft can significantly damage power semiconductors or cause unintended system behavior that can disrupt mission operations.



Pamela de Liz, President of the Ziled Group, asking very insightful questions. (Photo courtesy of Ken Lui)



Dr. Pellish showing the Mars Helicopter in the Mars 2020 Mission as an example of COTS in space missions. (Photo courtesy of Ken Lui)

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January's Professionals Networking Mixer Event *(continued from Page 3)*



Ms. Marilyn McPoland, the former Museum Director of Program (Left), and the current Museum Director, Mr. Steve Benesch. (Right) (Photo courtesy of Ken Lui)

The museum also houses a variety of unique aircraft stemming from a replica of the Wright Flyer, multiple Rutan designed aircraft, and even a 1959 Road Air original flying vehicle, that was designed by an inventor who was employed by the Douglas Aircraft Company. Among many other displayed aircraft, you can see a variety of “heavy metal” including a North American F-86 Sabre, and a Douglas A-4 Skyhawk.

The monthly Professionals Networking Event was a smashing success at the Museum of Flying! Going back in time to the aviation history in Southern California was not only fun, it was educational and inspiring for our event guests. With a great turnout, we witnessed many networking connections and the exchanging of business cards! We would like to thank everyone who attended, all the volunteers, especially Pamela, Philip, and Whitney, and the majestic museum itself for hosting. See you next month!

About the Authors (Mallorie Vanghel): Mallorie is an AIAA volunteer and council member. Growing up in Florida sparked an interest in space through space camp and launches from Kennedy Space Center. She now lives in Los Angeles and works in media.

(Marilyn L. McPoland)

(More about Marilyn can be found in the December Newsletter in the article about the Nov. 17 Aerospace Women's Networking Breakfast)

Currently, Marilyn holds the position of Director of Events at California State University, Dominguez Hills. In this role, she oversees a department that manages in

excess of 60 annual events. She is also involved in creating a documentary on the Dominguez Hills 1910 Air Meet.

Marilyn has served on Boards for the American Marketing Association, the Association of Western States Aviation Museums, and for the Association of Fundraising Professionals.



Council Member Ms. Mallorie Vanghel (Middle) and Volunteer Ms. Pamela de Liz (Right). (Photo courtesy of Ken Lui)



Marilyn L. McPoland

AIAA LA-LV 1/30 Dinner Meeting, featuring "In the Line of Duty: Michael Adams and the X-15" by Michelle Evans (30 January, 2020)

(Continued from Page 4)



Attendees engaging in enthusiastic Q & A: The Article Author, Mr. Drew Miller, asking a question. (Photo courtesy of Ken Lui)

To learn more about the incredible X-15 program, I highly recommend reading *The X-15 Rocket Plane, Flying the First Wings into Space* by Michelle Evans, as well as looking up Mach 25 Media (www.Mach25Media.com). Michelle's work is incredibly detailed, respected, and inspirational to current and future generations of aerospace professionals.



Artifacts recovered from the last flight of Michael Adams, displayed by the speaker, Michelle Evans. (Photo courtesy of Ken Lui)

About the Author: Drew Miller is an experienced engineer with a Bachelor of Science in Mechanical Engineering from North Carolina State University. He is currently a Lead Mechanical Design Engineer at Space Exploration Technologies Corporation (known as SpaceX) in Hawthorne, CA. Over the past 4+ years at SpaceX, Drew has designed, tested, qualified and flown hardware on Dragon 1 and Crew Dragon 2 in support of NASA cargo resupply and Commercial Crew programs. Prior to joining SpaceX, he was a Lead Mechanical

Engineer at General Electric for over 9 years, designing electronics controls packaging and environmental enclosures, mechanisms, thermal management systems, and dynamically-isolated structures. He is an active senior member of the American Society of Mechanical Engineers (ASME), Society of Automotive Engineers (SAE), and the American Institute of Aeronautics and Astronautics (AIAA). His interests outside of work include international motorsports, aircraft and flight operations, architecture and design, and motorcycle riding and road racing. He also enjoys hiking and camping, reading, and working on cars and motorcycles. This year he hopes to begin training on acquiring his private pilot license.



Photo courtesy of the article author, Drew Miller, next to the GE J79 engine of a F-104G Starfighter at the Palm Springs Air Museum. (Photograph by Danielle De Young)



The speaker's bestseller X-15 book displayed for book-signing. (Photo courtesy of Ken Lui)

JANUARY 30, 2020: IN THE LINE OF DUTY: MICHAEL ADAMS AND THE X-15

(Continued from Page 5)

Unfortunately, the program never took off for various social, political, and financial reasons. Michelle really brought out the rollercoaster of emotions Mike Adams felt in this period of his life through the words of Freida Adams. Yet, at the end of this tunnel, Adams found the X-15 program. As Freida described it, he was a new man with a purpose.

Michelle continued into the central part of the story and described several of Mike Adams' adventurous flights in the X-15. It really shows how passionate Mike was about the X-15, and how courageous he was to fly something at Mach 6.7 (4520 mph), when there was always something going wrong on these flights. The details of Mike's last flight was portrayed vividly by Michelle, it brought on a resonance of respect and regret. This was someone human just like all of us, with a mother who eagerly stood in the control room for the first time, with a dry sense of humor, and with the ability to make a mistake under extraordinary circumstances. The main culprit of the tragedy was a test pod that had never been tested in vacuum. It created a short circuit and caused the flight computer to malfunction and reset over and over again. Meanwhile, Mike had gotten distracted by the computer's behavior and misread the X-15's confusing pitch and yaw gauge, which could be set to show either pitch or yaw but not both at the same time. When he tried to correct his pitch, he was actually moving his yaw. He was yawed at 90 degrees and flying upside down, going into a hypersonic spin. The plane tragically exceeded its structural limits during its descent and broke apart, crashing, and killing Michael.

Michelle went on to the final section of the story: the aftermath. A memorial service was held at the Edwards Base Chapel. Freida and her children chose to move back to Louisiana, back to her roots in the south. Mike's Peak altitude ended up being 266,000 feet, which exceeded the 50 mile altitude mark that qualified someone to be an astronaut. In the end, Mike's dream of entering space was realized. In the aftermath, many people expressed discontentment because the X-15 program was being handled like "routine stuff" and that NASA had lost sight of what was important. Instead of questioning the lack of testing on the X-15 test pod, people assumed that since it had flown before, it should have been fine. Mike's death finally got people's attention that something was

systematically wrong in how the space programs were run. But tragically, it would take two space shuttle accidents for people to realize that having the courage to step forward and get the attention of authorities when problems exist is of paramount importance.



Amazing displays, including the material used for the X-15 (the silver plate on the left). (Photo courtesy of Ken Lui)

Michelle listened to and answered questions the audience still had after her hour-long presentation. Many of these were about the X-15 rocket plane. Michelle revealed that the area between the fuselage and wings of the X-15 had gaps to account for thermal expansion during hypersonic flight, and that the landing gear of the X-15 often opened up during hypersonic flight. One other interesting detail was that Neil Armstrong was actually a clumsy pilot whose landings were often dangerous. Michelle also brought along recovered artifacts such as the nose thruster of the X-15-3, a scale model of the plane, and a sample of Inconel-X, the nickel-based super alloy the X-15 was built on.



About the author: Mingyi Chen

(mingyichen95@gmail.com)

Mingyi is a mechanical design engineer at ProCustom Group, doing rugged computer system integration for the defense industry. He obtained his Master's degree in mechanical engineering specializing in control systems and robotic mechanisms from UCLA. In his undergraduate years, he was active in

Design-Build-Fly at UC San Diego. He is currently working on a miniature turbo-jet engine in his free time and loves to learn about anything that flies. He enjoys playing the violin and competitive table tennis. His dream is to send at least a screw into space, 10-32 100 deg flathead preferable.

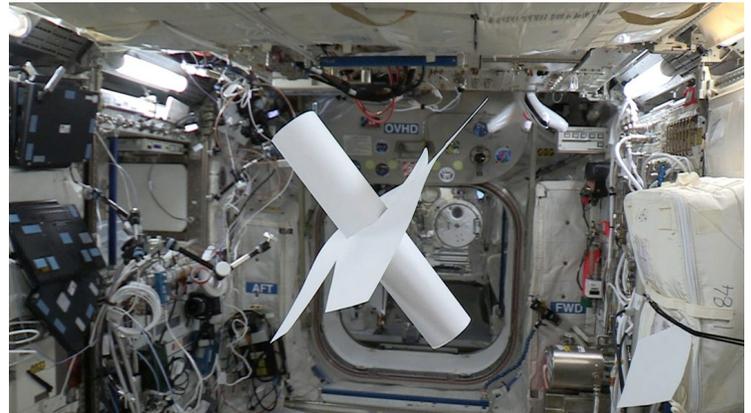
(Special) Inner Telescope, a Space Artwork by Eduardo Kac
A film by Virgile Novarina, production : Observatoire de l'Espace du CNES

(Continued from Page 7)

Rarely has a film shown the birth of a work so well. In a dramaturgy that is both very constructed and dreamy, Virgile Novarina makes us discover step by step the stakes of this work, participating in the questions of the artist and the astronaut, to finally lead to a silent and masterful sequence: Thomas Pesquet and "Inner Telescope" float in weightlessness, and the camera, also in weightlessness, also frees the audience from gravity. Thanks to the magic of cinema and the poetic potential of the work, this film takes us to new horizons.

<https://vimeo.com/250786057>

http://www.ekac.org/inner_telescope.html



Inner Telescope in the International Space Station. ©ESA, CNES, Eduardo Kac, Virgile Novarina



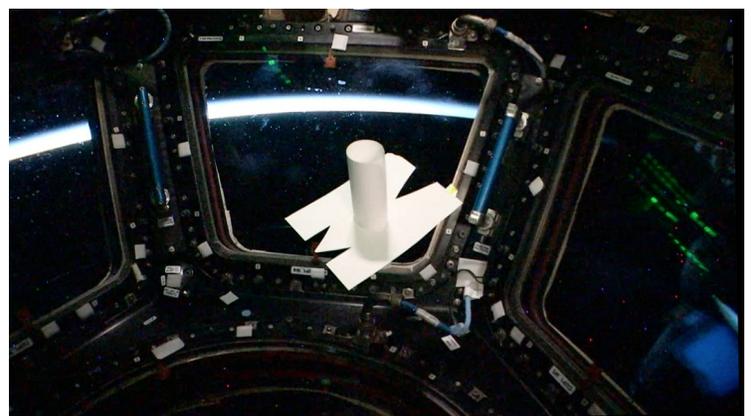
Thomas Pesquet in the International Space Station. ©ESA, CNES, Virgile Novarina



Thomas Pesquet in the International Space Station. ©ESA, CNES, Virgile Novarina



The artist Eduardo Kac and the astronaut Thomas Pesquet at the European Astronaut Center in Germany. ©Virgile Novarina, ESA, CNES



Inner Telescope in the International Space Station. ©ESA, CNES, Eduardo Kac, Virgile Novarina

**(Special) Artemis: MAXIM Mission Tribute to Apollo: Team Project 2019
 USC ASTE 527: Space Exploration Architectures Concept Synthesis Studio
 Madhu Thangavelu, Conductor (17 December, 2019) (Continued from Page 8)**



Apollo Mission Flight Director Gene Krantz looks on as NASA Administrator Jim Bridenstine inaugurates the fully restored and functional Apollo mission control room at Johnson Space Center. Maybe we should fire it up to fly this USC Artemis: Tribute to Apollo MAXIM mission (Photo courtesy of Madhu Thangavelu)

As the American vision and largesse in supporting the International Space Station program is being extended to create a truly global coalition with all nations participating to promote, preserve, protect and share the space cultural heritage of our species, we thought it fitting and proper that Americans pay tribute to the scientists, the engineers and the Apollo astronaut explorers who walked, drove, sang, prayed and played golf, and safely came home. We thought it important to remind the world and show a whole new generation where we had been fifty years ago, and what we did there. As some of the heroes have departed and others age gracefully, it is long past time to honor the very brave and unique corps of astronauts and their support team. They showed what is possible for our species, if we only set our collective will and minds and hearts to it.

The USC ARTEMIS Project: Tribute to Apollo offers some visions to rev up the past to power up the future of human spaceflight. Dear colleagues, space cadets, welcome to the Maximum Impact Moon Mission, the USC ARTEMIS: MAXIM mission...

Student Presentations:

- *Cislunar Transport and Communications Architecture (Robert Miller)
- *Fly Me to the Moon: The Common Descent Vehicle (Caleb Benn)
- *Radiation and Lava Tube Exploration (Sindhoora Tallapragada)
- *Mowing the Lune: Bringing Agriculture to the Lunar Ecosystem (Aliyah Arunasalam)
- *ACCESS Observatory and Camera Suite (Ryan George)
- *Next Gen Rover and Landing Architecture (Nick Cordero)
- *Operation Hermes - Journey of USC Artemis (Ulubilge Ulusoy)



Professor & Astronaut Garrett Reisman (holding the microphone) asking questions and making comments for the students. (Photo courtesy of Ken Lui)



Prof. Mike Gruntman (right, standing) giving suggestions and comments, with Prof. Madhu Thangavelu (left, standing) moderating. (Photo courtesy of Ken Lui)



Dr. Nahum Melamed (Aerospace Corp.) asking questions as a judge. (Photo courtesy of Ken Lui)

Electronic Parts in the New Space Paradigm *(continued from Page 9)* Speaker: Dr. Jonathan “Jonny” Pellish (NASA Goddard)



An attendee engaging in interactive conversations with the speaker. (Photo courtesy of Ken Lui)



Dr. Seth Potter making some comments. (Photo courtesy of Ken Lui)

Radiation effects have been studied since the beginning of the space race. Radiation can cause cumulative degradation of electronics or instantaneous events, some of which can be destructive. Radiation effects are challenging because the field evolves with the technologies we want to use. There is a broad range over which radiation effects can occur: wavelengths from 1 femtometer to 1 light year (1031 orders of magnitude range) and energy from 1 electron volt to 10¹⁹ electron volts, to consider just two dimensions. Clearly, there is a lot of variability that makes dealing with radiation effects challenging.

It comes down to understanding and managing risk. Technical/design risk (“The Good”) is related to the designs not being able to meet mission criteria. Programmatic risk (“The Bad”) is related to a mission missing a launch window or exceeding a budgetary cost cap, which can lead to cancellation. Radiation/reliability risk (“The Ugly”) is related to a mission meeting its lifetime and performance goals without premature failures or unexpected anomalies. Once these three types of risk management requirements are understood, each mission must determine its priorities among the three types. The evolving approach for radiation hardness assurance is to 1) define success for your mission and risk posture; 2) identify highest return on investment tests and analyses using model-based flows that meet mission success criteria; and 3) provide accessible infrastructure for tools, data sharing, etc. NASA’s bottom line goal is to provide appropriate and streamlined approaches for projects of all sizes.

Author bio: Karen Grothe has 16 years of experience working in the aerospace industry as a systems engineer at McDonnell Douglas, Boeing and Raytheon, and recently started a new systems engineering position at HRL Laboratories in Malibu. She has a passion for planetary science, astronomy, and space exploration, and in particular how small spacecraft (like CubeSats) can facilitate more of that. She is currently serving as the Membership Director for the INCOSE LA chapter and the Vice President of Education for the Westside Toastmasters club.



Dr. Jonathan “Jonny” Pellish explaining the radiation-hardening assurance. (Photo courtesy of Ken Lui)

Who is Invited: Professionals, Students, friends and family members.

(You do not need to be AIAA member to attend the event)

(Volunteers and Sponsors are needed for all AIAA activities)

Electric and Hybrid Aircraft mini-Conference

Saturday, February 22, 2020

Dr. Marty K. Bradley

AIAA Fellow

Technical Fellow for The Boeing Company

Boeing Commercial Airplanes Advanced Concepts Group

Cory Combs

CTO and Co-Founder

Ampaire Inc.

Joseph Oldham

President – New Vision Aviation

Sustainable Aviation Project – Flight Training with Pipistrel Alpha Electro Trainers

Additional Panelists

Dr. Anita Sengupta

Co-Founder at Airspace Experience Technologies (ASX)

Former NASA Engineer, Former Hyperloop Engineer

Scott Burgess

President and Co-Founder of the Eco-Aviation Foundation International



RSVP and Information: <https://conta.cc/36brp9F>

The Proud Bird, (The Mission Room, 1st Floor)

11022 Aviation Blvd., Los Angeles, CA 90045

(Southeast of LAX, South of 10 Hwy, North of 105 / Imperial Hwy, and West of 405 Hwy.)

(Free event parking in the Proud Bird Parking Lot)

Saturday, February 22, 2020, 10:00 AM - 2:30 PM (Check-in starts 9:30AM)

Presentation starts at 10:00 AM.

(Ticket sales will end after Thursday, February 20, 2020, or whenever tickets are sold out.)

Dress Code: Business or Business Casual

Contact: events.aiaalav@gmail.com (AIAA LA-LV Events/Program Chair)

*Volunteers are needed, please contact:

AIAA LA-LV Section Chair (cgsonwane@gmail.com)

See what's happening on our social sites: Please join us, take a look, and invite others!volunteers are needed for social media, please contact cgsonwane@gmail.com

Engage @ AIAA LA LV AIAA LA-LV Website : AIAA-LALV.org



Please check out the new website features, comment/like for blogs and provide feedback. Also, if you are interested in writing blog or newsletter articles, please contact us. Please also follow, join, share, and/or like our social media pages, groups or pin boards.

Monday, February 24th, 2020

Aerospace Professionals Networking Event

Spotlight: Engineers Week Celebration and AIAA Headquarter Executives



Location: The Proud Bird Food Bazaar & Event Center (Open Bar Area)
11022 Aviation Blvd., Los Angeles, CA 90045

Time: 5:00 PM – 8:00 PM, Dress code: Business Casual / Casual

Who is invited: Aerospace professionals, family, and friend

Price: \$4.95 (Light hors d'oeuvres and refreshments provided)

RSVP and Information: <https://conta.cc/2XDGbBX>

You do not need to be a member of AIAA to attend the event. Volunteers are needed for all AIAA activities.

Volunteers are needed, please contact: AIAA LA LV Section Chair (cgsonwane@gmail.com)

For event questions, please contact: Events/Program Chair (events.aiaalav@gmail.com)

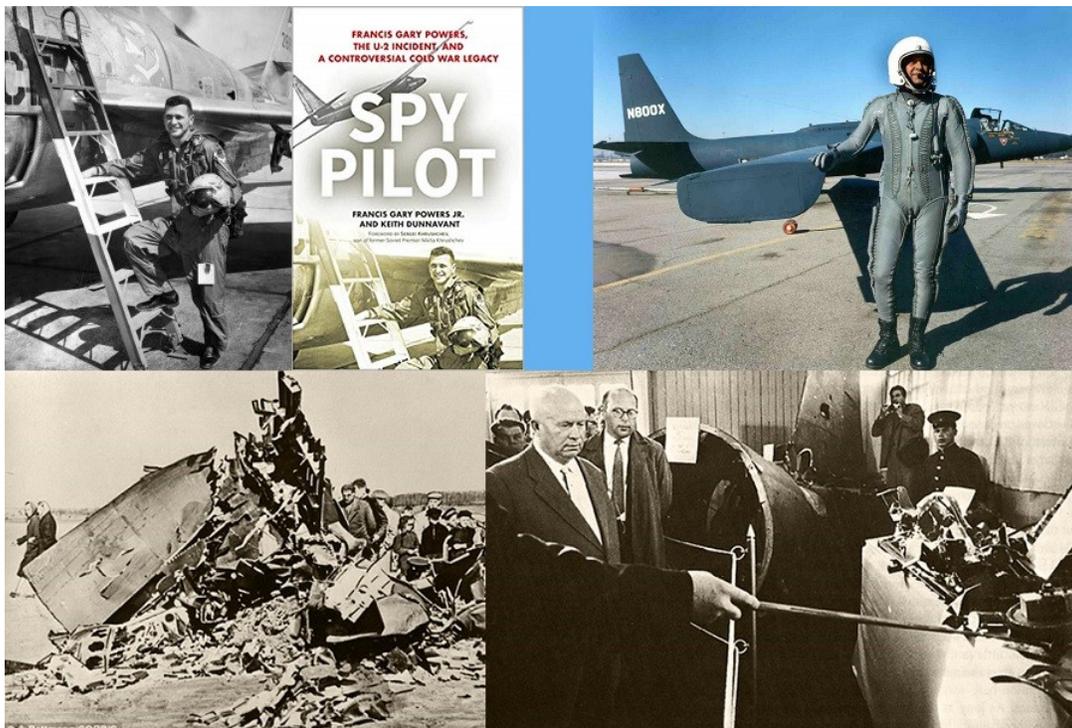


Thursday, March 5th, 2020

Spy Pilot, Francis Gary Powers, the U-2 Incident, and a Controversial Cold War Legacy

Speaker: Francis Gary Powers Jr.

Moderator : Prof. Mike Gruntman



Location: The Proud Bird (1st Floor, The Aviator Room)

11022 Aviation Blvd., Los Angeles, CA 90045

Time: 5:30 PM – 9:30 PM, **Dress code:** Business Casual

RSVP & Information: conta.cc/2tZ9ohw

Price: \$4.95 Presentation Only - No Dinner: Student (6 yr old+)

\$9.95 Presentation Only - No Dinner: Regular

\$29.95 Dinner Ticket: Student (6 yr old+)

\$34.95 Dinner Ticket: Regular

You do not need to be a member of AIAA to attend the event. Volunteers are needed for all AIAA activities. Volunteers and Event Sponsors are needed, please contact: AIAA LA LV Section Chair (cgsonwane@gmail.com) For event questions, please contact: Events/Program Chair (events.aialalv@gmail.com) (Free 1-year e-membership: www.aiaa.org/emember)





Saturday, March 7th, 2020

3rd AIAA LA LV University Student Branches mini-Conference



Location: Michelle Obama Neighborhood Library (Community Meeting Room)
5870 Atlantic Ave., Long Beach, CA 90805

Time: 10:00 AM – 3:00 PM, **Dress code:** Business Casual / Casual

Student presentations and posters from Universities judged by Aerospace Industry veterans for Prizes, posters, industry exhibitions, panel sessions & talks, career advice panel
All students, professionals, educators, and their family/friends are welcome.

Prizes for top poster and presentations will be awarded.

Lunch Time Aerospace Career Workshop on resume writing / interview tips for various engineering, medical, art etc. disciplines by experts from the industries

Price: FREE!!! (Free bottled water)

RSVP & Information: conta.cc/2nzeKM2

You do not need to be a member of AIAA to attend the event. Volunteers are needed for all AIAA activities.

Additional speakers are needed for this event, please email: cgsonwane@gmail.com

For event questions, please contact: Events/Program Chair (events.aiaalalv@gmail.com) or (949)426-8175



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engage.aiaa.org/losangeles-lasvegas



Friday, March 27th, 2020

Aerospace Professionals Networking Event

Spotlight: ISS US National Lab Representatives and leaders in ISS efforts



Location: The Proud Bird Food Bazaar & Event Center (General bar area)

11022 Aviation Blvd., Los Angeles, CA 90045

Time: 5:00 PM – 8:00 PM, Dress code: Business Casual / Casual

Who is invited: Aerospace professionals, family, and friend

Price: \$4.95 (Light hors d'oeuvres and refreshments provided)

RSVP & Information: conta.cc/2tZ4zmT

You do not need to be a member of AIAA to attend the event. Volunteers are needed for all AIAA activities. Volunteers and Event Sponsors are needed, please contact: AIAA LA LV Section Chair (cgsonwane@gmail.com)
For event questions, please contact: Events/Program Chair (events.aiaalav@gmail.com)
(Free 1-year e-membership: www.aiaa.org/emember)



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Saturday, March 28th, 2020

International Space Station U.S. National Laboratory @AIAA Los Angeles – Las Vegas

Rachel Clemens, PhD

Commercial Innovation Manager

ISS U.S. NATIONAL LABORATORY

Representatives from Different Sectors working with ISSNL in Physical Sciences, Life Sciences, Remote Sensing, Space Development, and Education

Talbot Jaeger (Remote Sensing)

NovaWurks, Los Alamitos, CA

Prof. Mary Kearns-Jonker (ISS Space Medicine)

School of Medicine, Loma Linda Univ., Loma Linda, CA

Jana Stoudemire (Implementation Partner)

Space Tango, San Diego, CA

Dr. Jeffrey Puschell (Moderator)

Raytheon Space and Airborne Systems

AIAA Fellow

Andre Doumitt

Director – Innovation Development

The Aerospace Corp.

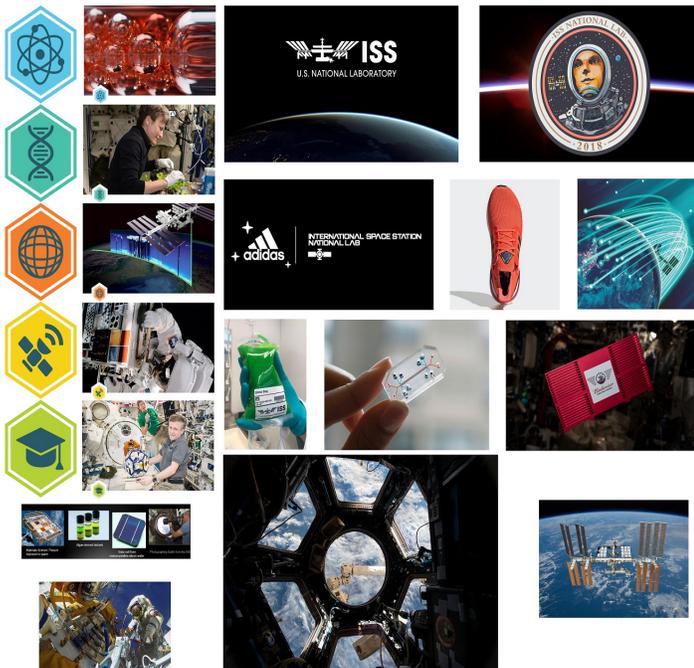
Co-Founder, Space Venture Coalition

Y. Joyce Liao, MD, PhD

Professor of Ophthalmology and of Neurology

Stanford University Medical Center

(Microgravity Space Medicine)



Location: Northrop Grumman S-Cafe

One Space Park, Redondo Beach, CA 90278 (Enter from Simon Ramo Drive)

Time: 10:00 AM – 3:00 PM, Dress code: Business Casual / Casual

RSVP & Information: conta.cc/36SuCea

Price: \$0 (Free): Entry only, \$9.95: Entry with pizza and bottled Water

\$24.95: Entry with lunch and soft drink

(Free 1-year e-membership: www.aiaa.org/emember)

You do not need to be a member of AIAA to attend the event. Sponsors and volunteers are needed, please contact: AIAA LA LV Section Chair (cgsonwane@gmail.com)

For event questions, please contact: Events/Program Chair (events.aiaalav@gmail.com)



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(A non-AIAA event) 3D Printing and Space, Feb. 22, 2020, 4 PM – 7:30 PM, Santa Monica, CA
www.eventbrite.com/e/3d-printing-space-tickets-90487070263