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

Newsletter

April 2019

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Evolution to Electric and Hybrid Aircraft

AIAA Los Angeles-Las Vegas Dinner Meeting, February 20, 2019

By Gus Ordonez

Principal and Founder of Icarus Aerospace Consulting; AIAA Associate Fellow

The AIAA Los Angeles/Las Vegas Section sponsored the "Evolution to Electric & Hybrid Aircraft" lecture, presented by Dr. Evgeni Ganev. The lecture was held on February 20, 2019 at the Manhattan Beach Library Conference Center. Dr. Ganev is Chief Engineer for Electromechanical Power Systems at Honeywell Aerospace, Torrance, CA, USA.

Dr. Evgeni Ganev. *Photo: Kenneth Lui, Events/Programs Chair, AIAA Los Angeles-Las Vegas Section*

Dr. Ganev walked the audience through the reasons behind electric aircraft architecture, its benefits and drawbacks, and later introduced future aircraft needs that included Urban Air Mobility and Next Generations electric aircraft. In summary, Electric and Hybrid aircraft are progressing at a fast pace, with entry into service for the new aircraft generation with power up to 600 KW expected in 2022 to 2025. A 10MW power level, typical of a regional aircraft, may be available by 2030. The first-generation Narrow Body and second generation Wide Body are expected to span from 2035 till 2050.

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Venus, The Stranger Next Door: 57 Years of Space Exploration to Earth's Twin Sister
A presentation by Dr. Thomas Navarro, Postdoctoral Researcher at UCLA
AIAA Los Angeles-Las Vegas Section Meeting, Saturday, February 9, 2019

By Roger G. Gilbertson
Solax Media

On a recent sunny Saturday morning, Dr. Thomas Navarro, Postdoctoral Researcher at UCLA, took us on a journey to our nearest neighbor – planet Earth's cloud- and mystery-shrouded twin, Venus. The Lawndale Library hosted the well-attended gathering, and audience members listened with attention, posing many interesting questions to the presenter. He in turn shared with us what a challenging, diabolical, and surprising world we have next door.

Dr. Navarro works as a planetary scientist with special interest in the atmospheres of Mars and Venus. He received his PhD in Planetary and Atmospheric Sciences from the Université Pierre et Marie Curie, in Paris, France, and served as a Doctoral Researcher at the Centre National d'Études Spatiales (CNES – France's national space agency), where he studied the meteorology of Mars "using satellite data assimilation and modeling." He is currently a postdoctoral researcher at UCLA studying the climate of extraterrestrial planets, and is a participating scientist aboard Japan's Venus Climate Orbiter mission, also known as Akatsuki (Japanese for "dawn"), currently the only spacecraft operating at Venus.

Launched in May of 2010, Akatsuki arrived at Venus in December 2010, but a problem with the craft's orbital insertion engines prevented it from decelerating and achieving Venus orbit. Instead, it flew past and continued to orbit around the Sun. Managers developed a program of corrective measures to rescue the mission, and the craft eventually entered Venus orbit in December 2015. It has since performed investigations into the Venusian atmosphere using a suite of instruments and cameras. In April 2018 it completed its originally planned mission and entered into an extended series of operations, currently ongoing.

Dr. Thomas Navarro. *Photo: Kenneth Lui*

Dr. Navarro's studies of both Mars and Venus give him excellent standing to compare and contrast these two vastly different worlds which have dominated humanity's planetary exploration efforts. So far, Earth has sent 26 missions to Mars that have been considered as successes, compared to 38 missions that have traveled successfully to, or past, Venus. Taken together, these worlds reside at the edges of the "Too Hot" and "Too Cold" portions of the Goldilocks zone, and serve to teach us about our "Just Right" home world.

EARLY VENUS MISSIONS

Venus had the distinction of receiving the Earth's first interplanetary mission – NASA's Mariner 2 spacecraft,

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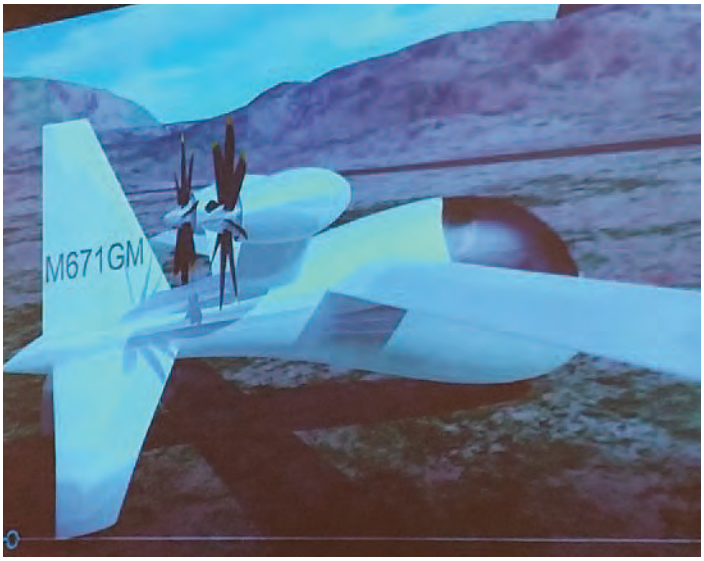
Aircraft Energy Gain from an Atmosphere in Motion
AIAA Los Angeles-Las Vegas Dinner Meeting, January 30, 2019

By Kenneth Varghese
Propulsion Stress Analyst, Boeing Commercial Airplanes

With a wingspan twice the height of the average man and the ability to travel 10,000 miles in a single journey, the albatross demonstrates one of the most awe-inspiring examples of sustained flight that nature has designed. J. Philip Barnes MSAE, Senior Technical Fellow of the Pelican Aero Group and a 40-year veteran of air-vehicle and subsystems performance analysis, conjured this feeling of awe in members of the AIAA Los Angeles-Las Vegas section on January 30, 2019 with his presentation "Aircraft Energy Gain from an Atmosphere in Motion." Barnes explored what a regenerative-electric aircraft has in common with the wandering albatross through technical explanations and simulations of how both extract energy from vertical or horizontal winds to augment or sustain continuous flight expending almost no energy.

J. Philip Barnes shows the wingspan of his flight model: an albatross! *Photo: Kenneth Lui*

Barnes first described what appears to be the magic of the albatross' shoulder-locked wings sustaining its flight around the Antarctic continent, an ability which appears to defy physics and one that naturalists Jacques Cousteau and David Attenborough both have observed and documented. But the laws of physics, as Barnes notes in his presentation, must be obeyed. When a pointed upwind albatross flies against the headwind, if the bird encounters a sudden gust of headwind it will enjoy a sudden increase in airspeed – increased flight kinetic energy based on airspeed, not groundspeed. When an albatross flies downwind it experiences a tailwind. Its airspeed remains approximately constant but groundspeed increases. If the tailwind suddenly decreases, a sudden increase in airspeed is observed. Hence, the groundspeed remains constant as the airspeed undergoes a sudden change. The albatross moves across a shear layer or wind gradient; increasing headwind or decreasing tailwind yields an energy gain which leads to the phenomena of dynamic soaring: flight with little energy expenditure. Barnes had developed a simulation of the flight pattern of the albatross, and showed it at the meeting. For more details related to the physics of dynamic soaring, refer to "How Flies the Albatross – the Flight Mechanics of Dynamic Soaring" by J. Phil Barnes, published in SAE International (November 2-4, 2004).



Barnes went on to describe how a regenerative-electric aircraft can similarly exploit airspeed for efficient flight. This can primarily be accomplished through ridge lift, where a mountain or cliff that is

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X-15 Rocket Plane History, Space Art, STEM and a Las Vegas Spaceport Update

On March 5th, an author-artist event was held at the Air Force's Center of Innovation (AFWERX) in Las Vegas, NV. The event was loosely modeled on the very successful Artist-Scientist event held in Los Angeles, CA in May of 2016.
Visit AFWERX Website: https://www.afwerx.af.mil/

Author Michelle Evans is the founder and president of Mach 25 Media and is a writer, photographer, and communications specialist in aerospace. She has written the bestselling book "The X-15 Rocket Plane, Flying the First Wings into Space," which was published by the University of Nebraska Press as part of their "Outward Odyssey, People's History of Spaceflight" series. She is a Distinguished Lecturer with the AIAA, and her book on the X-15 was a finalist for the Eugene M. Emme Award for Astronautical Literature. Michelle has appeared in numerous publications, including Air & Space Smithsonian, Ad Astra, Orange County Register, Los Angeles Times, and New York Times. She was a technical consultant on the Neil Armstrong biopic "First Man."

Michelle provided an overview of her book on the hypersonic X-15, a winged rocket ship that opened the way for human-controlled spaceflight. Included were highlights of her interviews with the pilot/astronauts and their families who made this the most successful research aircraft ever flown, the true precursor to the Space Shuttle. These included Scott Crossfield, Joe Walker, Robert White, and a young Neil Armstrong before flying into orbit and beyond during Gemini and

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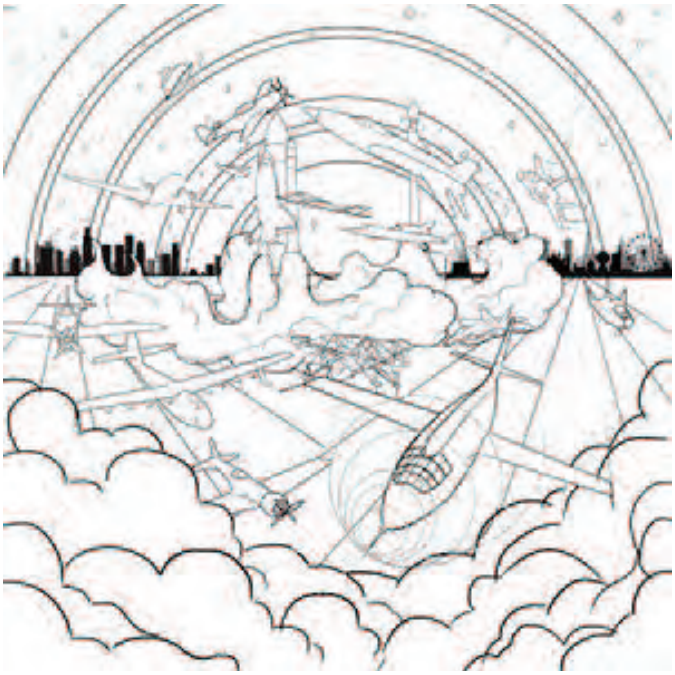
The awards for the AIAA Los Angeles-Las Vegas Section will have a new look! Congratulations to Artist Sophia Leon!

The LA-LV Section decided to update our award plaque artwork last year, since the previous artwork was quite dated. In an effort to capture the history and vitality of the Aerospace industry and contributions of the Southern California and Las Vegas areas, your Council sponsored a contest among our affiliated Student chapters at UNLV, UCLA, USC, and CSULB. After evaluating a large number of submissions, we selected a submission from Sophia Leon, UNLV, as the winner of the $500 award.

Sophia is a Mechanical Engineering student at UNLV and is currently in her junior year. Her artwork will be used on many of our awards and plaques going forward. She was inspired by the style of the artwork of Bob McCall, which she had seen at several NASA centers that she has visited. Please join us in congratulating Sophia, both on her artistic talent and the win.

Left: An example of the former artwork used on Section plaques and awards. Though relevant in the 1980's, the Council decided we needed a much updated artwork to reflect the vibrancy of the New Space and other activities within the section!

Right: Sophia Leon's winning submission that will be used in future Los Angeles-Las Vegas Section plaques and other awards. The skylines of Los Angeles and Las Vegas are presented, with historical air and space vehicles ranging from the Spruce Goose and X-1 to the modern Falcon 9 and Sierra Nevada Dreamchaser that may someday be landing at the planned Las Vegas Spaceport.



X-15 Rocket Plane, Space Art, STEM and a Las Vegas Spaceport Update *(continued from page 4)*

Apollo. Also discussed were Michael Adams, the first American astronaut lost in the line of duty during a spaceflight. For more information about Michelle, please visit http://www.Mach25Media.com

Electrical Engineer and Aerospace Artist Michelle Rouch is the current Vice-Chair for AIAA Tucson Section and a member of Society and Aerospace Technology IOC, Founder and Co-chair of the Tucson-Chapter of International Association of Astronomical Artists, a member of American Society of Aviation Artists, a Tucson Public Arts Council Board Member, nominated for 3 consecutive years for the Governor's Arts Awards, and served for 3 years as a judge for Representative Martha McSally's Congressional Arts Program.

Rouch is a self-taught artist with over 35 years of experience; she combines her technical knowledge to create unique pieces of aerospace subjects. Her artwork promotes science and engineering and continues to develop new techniques to redefine aerospace art with a contemporary approach. At this event, Rouch displayed many of her meaningful works, and gave a discourse on the highlights of her most meaningful pieces. Visit her website at: http://rouch.com

AIAA-Las Vegas Chapter President Marty Waldman also gave an update on the ongoing effort to have Las Vegas granted a Spaceport Landing License. This license will efficiently establish Las Vegas as a hub of Aerospace/Technical excellence recognized worldwide. The enabler of this effort is Sierra Nevada's "Dream Chaser" vehicle https://bit.ly/2Hgp6sp that can land on any runway 10,000' or greater, and Las Vegas has four such runways...two at Nellis and two at McCarran. Our AIAA Chapter is currently engaged on all political levels to move this from an idea into reality, a reality that defines a parallel branding of Las Vegas to that of being a worldwide high-tech center of excellence.

Aircraft Energy Gain from an Atmosphere in Motion *(continued from page 3)*

steep and large enough can deflect the wind upward. This in turn results in rising air, which can be used to generate lift, and energy recharge through airborne wind turbines, where a wind prop with a symmetrical airfoil can function as a propeller or turbine depending on whether positive torque is applied to the wind prop. Barnes concluded his presentation with a stunning simulation of a regenerative-electric aircraft in operation. Further information about regenerative electric flight can be found in the paper “Regenerative Electric Flight: Synergy and Integration of Dual-role Machines” by J. Philip Barnes from the 53rd AIAA Aerospace Sciences Meeting, AIAA SciTech Forum (AIAA 2015-1302).

The AIAA Los Angeles-Las Vegas Chapter thanks J. Philip Barnes for this presentation and his continual efforts to inspire the future of sustainable aviation through his work.

With an MSAE from Cal Poly Pomona and BSME from the University of Arizona, J. Philip Barnes has authored AIAA, SAE, AAS, and ASME papers on diverse topics including electric flight, aerodynamics, propellers, and the mechanics of gears, Keplerian orbits, and dynamic-soaring flight. Recently named Cal Poly Aero Engineering Alum of the Year, where he presented Learning From the Birds to graduates, families, and faculty, Barnes has given several invited, travel-paid lectures at universities including USC, UIUC, and Univ. of Dayton. He frequently mentors engineering students with their capstone projects, and the fruits of such collaboration often appear in his technical papers and presentations.

Kenneth Varghese, the article author, is an engineer at Boeing. He graduated from Rensselaer Polytechnic Institute in 2017 with a BSAE and is interested in sustainable aviation. Varghese lives in Long Beach, where he enjoys planting trees and running.

Evolution to Electric and Hybrid Aircraft

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The new electric aircraft technology is a game changer for smaller aircraft that brings manufacturing to a larger scale, as in the case of Urban Air Mobility Aircraft, where production models can reach several thousand aircraft and can create a new aviation model for urban transportation.

In the last several years, more than 100 original equipment manufacturers (OEMs) have been created, from startups to traditional aircraft manufacturers, where combined production estimates across the market may reach over 50,000 vehicles per year and a market valuation in the order of USD $70B by 2035.

The goals of electric aircraft are well defined: reduction of fuel consumption and hazardous liquids, improvement in dispatchability, added comfort for passenger connectivity, and more environment friendly and green technology. These goals are believed to be attainable, and specific designs are being tested to prove their reliability. Many trade studies are in play in the area of Electric vs. Hybrid architectures, especially in terms of aircraft modification and retrofits in order to upgrade a potential fleet of 30,000 aircraft presently flying around the world. Another aircraft system being reviewed is the Flight Controls architecture, where Motor Controllers, Speed Control, and Flight Control Surfaces will be driven by voltage and current specific hardware.

The system architecture studies have defined promising gains for small aircraft. An example is the Urban Air Mobility aircraft model, where no more than 4-5 passengers will be able to navigate through a short distance across a city with ease. The electric architecture needs to be coupled with the autonomous navigation system. Power will be the protein of flight, where autonomy, flight controls, guidance and navigation, and thrust will be electrically driven.

The implementation of electric and hybrid air vehicle architectures will then move from smaller to larger aircraft as the certifications are progressing. This is why industry analysts believe that this technology becomes a game changer for regional aircraft and aviation transport as a whole.

Experts believe that electric propulsion will continue to progress in several phases across the design architectures of the aircraft, primarily due to qualification- and certification-driven timelines. Auxiliary power systems have proven that ground electric power can be extracted from a Fuel Cell-driven APU as well as an electrically driven motor. At this point battery demand and voltage considerations become critical, since the demand for electrical power inside the cabin will be dictated by the ability to generate electrical power required for the entire ground and flight segments and to satisfy the needs of an aircraft that flies 200 passengers. There will be an increased demand for power inside the aircraft, and for power production.

Safety is the critical driver for this architecture. Regarding that, the trade study between Electro-Hydrostatic and Electro-Mechanical flight controls appears to be at play, with the goal of eventually moving into an all-electric actuation system for flight controls. Redundancy and backup power systems will be needed for Airworthiness Certifications and Entry Into Service considerations.

A salient point behind the trade studies is the ability to reach normal operating flight conditions with motor controllers and batteries. Voltages from 540 Volts DC up to 10,000 Volts DC will be implemented depending on the size of the aircraft. Skin temperatures, metal duty cycle for enclosures, cooling mechanisms and ventilation systems will need to handle the environment. And as mentioned previously, when we add the pilotless transportation mode, coupled with autonomous Guidance and Control and GPS, the technological feat is of large proportions. Industry continues to mature these technologies at a rapid pace.

There are some risks and challenges behind the deployment of these architectures. We note safety concerns due to increased operating power and voltages, including the hazard created around the airframe structure and personnel using the high voltage electric equipment. Another risk area is the handling of flight actuators and their regenerated power, including

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Venus, The Stranger Next Door

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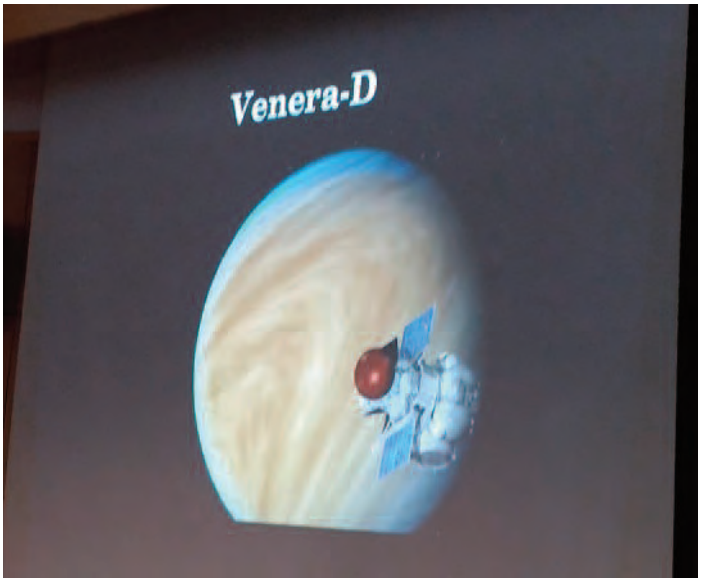
built and operated by the Jet Propulsion Laboratory in Pasadena, which flew past Venus in December 1962, and confirmed the planet's extremely hot surface conditions. Mariner 2 also observed a lack of magnetic fields and radiation belts there.

Venus also received the Earth's first successful planetary lander missions: the Soviet Union's Venera 7, which touched down in December of 1970, and Venera 9, which returned the first images from the surface in 1975, as well as additional missions that survived for up to two hours under Venus's crushing surface pressures (92 times Earth's), and hellish temperatures (460 C or 860 F) hot enough to melt lead.

In the mid-1980s the Soviets sent the Vega 1 and 2 missions to Venus (and then onward to Halley's comet). Both of their instrument-laden balloons cruised through the upper atmosphere at around 50 km above the surface, and returned data for more than 46 hours.

From 1990 to 1994 NASA's Magellan spacecraft orbited Venus, producing a detailed radar map that covered 98 percent of the planet's surface. It revealed evidence of volcanic flows, strange erosion channels, erratic surface winds, and other very unusual features.



The Soviet Union's planetary lander mission to Venus.
Photo: Kenneth Lui

THE "TOO HOT" PLANET

Venus has a slightly smaller diameter than Earth (6,052 vs 6,371 km), and has a mass of approximately 82% of

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Evolution to Electric and Hybrid Aircraft

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bidirectional buses. Weight compliance is a risk and will continue to be tracked as new systems develop and become operational.

The impact of electric aircraft architectures will challenge the existing Supply Chain. The US supply chain has been stretched due to the higher demand of commercial aircraft, and it is noted that electric architecture suppliers are not in a position to react to a potential large wave of aircraft component requests.

Dr. Evgeni Ganev is a chief engineer for Electromechanical Power Systems at Honeywell Aerospace, Torrance, CA, USA with 40 years engineering experience. His expertise is in More Electric Architectures, high-speed electric machines and power electronics for power generation systems, electric drives and electromechanical actuators. He served as a systems and chief engineer on numerous aerospace programs for space, commercial and military aircraft. Platforms F-22, ISS, JSF, Space Shuttle, Predator B, A380, A350, NG Jammer, 777X, Electric Green Taxiing System and Next Generation Jammer. Mr. Ganev published 43 papers and holds 45 US patents.

Article Author Bio: Gus Ordonez is Principal and Founder of Icarus Aerospace Consulting, and AIAA Associate Fellow. He has been a member of AIAA since 1979, and has published in the fields of aircraft integration. Gus previously served as Director of Advanced Programs at Honeywell Aerospace, and most recently as General Manager of the Defense Enterprise at United Technologies Corporation.

Venus, The Stranger Next Door

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Earth's. Venus rotates on its axis with only a very small inclination to the ecliptic plane – just 2.7 degrees, compared to Earth's 23.5 degree tilt. However, it rotates about its axis in a retrograde manner – turning clockwise as viewed from the "north" of the solar system – in contrast to all other planets (except for Uranus which "lays on its side").

Given that Venus orbits closer to the Sun (at 0.72 of Earth's orbit radius), it receives twice the solar irradiance. However, due to its thick cloud cover that reflects and diffuses the light, the illumination at Venus's surface is about equal to that on the Earth.
Paradoxically, Venus is the hottest planet in the solar system, far hotter at its surface than the planet Mercury, which orbits much closer to the sun (at 0.31 Earth orbit radius). Indeed, the possible reasons for Venus's extreme surface temperatures are deeply intertwined with how increased atmospheric carbon dioxide levels due to the burning of fossil fuels threatens to increase Earth's surface temperature.

Simulation of Venus conditions to test endurance of equipment destined for the planet. *Photo: Kenneth Lui*

Venus has no major satellite like our Moon, nor even any minor satellites like Mars' Phobos and Deimos. In addition, whereas both Earth and Mars have day lengths of between 24 and 25 hours, Venus takes an amazing 243 Earth days to complete one rotation on its axis. Additionally, Venus takes 225 Earth days to circle the Sun – meaning that a day on Venus is 8% longer than its year! (This is a real challenge for devising a Venusian calendar.)

STRANGENESS IN THE ATMOSPHERE

These facts only begin to reveal the oddness of Earth's cloud-shrouded neighbor. Though the surface of the planet turns very slowly, winds in the upper atmosphere whip around the planet at sixty times its rotation speed – circling the planet in about four Earth days. The difference between the fast circulation of the upper atmosphere and the slow rotation of the surface below creates some very interesting dynamics. For example, just as the Sun's gravitation pulls the Earth's oceans to create tides, it also pulls and distorts Venus's thick atmosphere as well as its surface. The intense solar heating of the atmosphere also creates additional expansion and deformations. These forces combine to generate differential torques that prevent Venus from becoming tidally locked with one face towards the Sun at all times (as the Moon has become locked to the Earth). This appears to be a stable situation, with all the forces serving to reinforce Venus's current rotation rate.

The chemistry of Venus' atmosphere also differs greatly from Earth's. Venus' atmosphere has much more total mass. Earth's atmosphere is about 78 percent nitrogen. However, although Venus has a total of four times more nitrogen than Earth, it makes up only 3.5 percent of Venus's atmosphere – the rest being almost entirely carbon dioxide (96.5%) with just traces of water vapor, sulfur dioxide, and sulfuric acid.

The thick atmosphere of Venus also has multiple layers of dense clouds. As on Earth, solar heating drives atmospheric circulation. But on Venus, large "Hadley cells" cycle through both hemispheres, drawing the atmosphere at low altitudes around the poles towards the equator. There, solar heating lifts the atmosphere upwards, and the cells carry the flow back towards the poles. The Hadley cells concentrate energy and flow at

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Venus, The Stranger Next Door

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the poles, creating strong, deep, chaotic vortexes that, when viewed in various infrared wavelengths, look like peering down into a running food processor.

Infrared viewing also reveals large standing waves that form just before the "dusk edge" of the planet. Just as rocks submerged in a shallow stream lift the water to form ripples on the stream's surface, mountains on the surface of Venus cause the atmosphere to rise and generate gigantic ripples high above. These immense standing waves, the size of whole countries on Earth, shift gradually from mountain to mountain as the surface below turns slowly under rapidly moving cloud layers.

STRANGENESS ON THE SURFACE

The surface of Venus does not currently appear to have any liquids that form streams, lakes or oceans, though it may have had liquid water some four billion years ago, before the atmosphere thickened and pressures increased. However, at an altitude of ten kilometers and below, the intense pressure of the atmosphere may cause atmospheric carbon dioxide to become a "supercritical fluid," having some of the properties of both liquid and gas. This could be involved with some of the unusual surface formations and signs of erosion, and is an interesting area for further research.

Given that Venus is the only planet in our solar system named for a female deity, recent tradition holds that all features on Venus's surface, including plains, canyons, volcanoes and other formations, are named after females – both mythological and real. The most prominent exception to this rule is Maxwell Montes, named for physics pioneer James Maxwell, whose work led to the discovery of radio waves, which in turn have permitted the mapping of Venus.

Maxwell Montes is a mountainous belt that includes the highest point on the surface (11 km above the datum, Venus's equivalent of "sea level"), and was first observed in 1967 by the Arecibo Radio Telescope in Puerto Rico. The peaks of the region have areas with steep slopes, and have bright radar reflections that could be the result of a metallic "snow" deposited on their surfaces, possibly made of lead sulfide or bismuth sulfide!

Radar maps of Venus reveal a distinct lack of craters, and appear to be subjected to some form of reworking. Estimates for the current age of the surface range from just 0.5 to 1 million years old. We see no evidence for giant impacts, nor any massive volcanoes, so there must be some other set of forces are continually reworking the surface. This presents another great mystery to investigate further.

Instead of plate tectonics, Venus appears to have large circular areas that may function like subduction zones on Earth – providing a way for surface materials to sink back into the planet's interior. The surface also appears to have structures resembling volcanoes. In particular, Idunn Mons, is a target of interest as a possible source of gaseous or solid material releases.

Unlike our long periods of continuous observation of Mars, we have only limited stretches of continuous observation of Venus's surface and atmosphere. Between the end of data collection in 1995, and the resumption in 2006, we noted a large increase in sulfur dioxide in the atmosphere, which may be a sign of volcanic activity. The evidence for ongoing active processes provide additional good reasons for sending more missions to Venus, and maintaining continuous observations.

FUTURE MISSIONS AND THE QUEST FOR LIFE

Given the outrageously difficult engineering demands for devices to survive on the surface of Venus, researchers have looked at other ways that might be used to sense and measure the conditions down below. Recent observations on Earth have discovered natural phenomena that couple our planet's surface to its atmosphere. During the April 2011 earthquake in Fukushima, Japan, the tsunami wave that travelled across the Pacific Ocean also caused a pressure wave in the atmosphere. The wave propagated upwards and generated a phenomena known as "airglow" high in the ionosphere. This was detected as very low frequency and low frequency (VLF/LF) signals, which can be measured by satellites and even properly configured ground systems. We might be able to use similar

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phenomena on Venus to to read surface changes such as earthquakes.

High in its atmosphere, Venus has zones where the pressures and temperatures are distinctly Earth-like. These areas can be seen in various wavelengths to have curious bands and gaps caused by some unknown absorber of ultraviolet radiation. Some researchers propose that microorganisms could live high in Venus's atmosphere, safe from the hellish conditions below, and thriving on abundant solar energy. Future missions may seek to sample these clouds to determine what causes the bands, and search for the first evidence of life beyond Earth.

The successes of the Soviet missions stand as testaments to their engineering prowess. But Venus's extreme surface conditions will challenge future mission designers to create ways of lasting longer on the surface than just a few hours. Various groups at NASA have investigated electronics that can function for long periods at oven-like temperatures. Others have looked into mechanical "clockwork" rovers that could wander Venus for long periods of time and return useful data from the surface.

Given the possibilities of life living in high in the atmosphere, various balloon- and aircraft-based missions have also been proposed. Towards the end of his presentation, Dr. Navarro shared a video for a mission called VAMP for Venus Atmospheric Maneuverable Platform, looking like something straight out of Jack Northrop's notebook (perhaps not surprisingly as it was proposed by Northrop-Grumman). A satellite would deliver a giant inflatable flying wing to the upper levels of Venus's atmosphere, where it would then fly under solar electric power for months or even years, sampling the clouds for chemistry and possible signs of life. It could also carry radar systems for observing the surface some 50 kilometers below, and could provide researchers with unprecedented access, maneuverability and data unlike any gathered so far.

Venus promises endless new mysteries, new surprises, and new insights to help us understand the Earth and the zoo of exoplanets. Venus clearly deserves more attention in our future space mission planning efforts, and should continue to provide a valuable return on our investments.

Ultimately, we visit other worlds to learn more about our own. We are grateful to Dr. Navarro for taking time to share with us his knowledge, experience and excitement for the mysterious world next door. We look to his future discoveries and those of his Venus-focused colleagues as they continue to reveal the secrets of our amazing universe.

ARTICLE AUTHOR BIO

As a child in the 1960s, Roger found equal inspiration in the Apollo Program and Stanley Kubrick's "2001: A Space Odyssey." These early interests set him on a dual-track life and career path. In college he studied aerospace engineering at USC, while managing to spend his free time around the school's film and television department. After two years in Silicon Valley he and friends started what would became the Internet's leading robotics source of the day, RobotStore.com, where he created numerous robotic kits and books about "Muscle Wires" – solid state Shape Memory Alloy actuator materials, and provided some to NASA for the Materials Adherence Experiment which flew aboard the Mars Pathfinder Sojourner rover. In 2005 Roger played the role of Igor Sikorsky for the History Channel's program "Sikorsky and the Rescue Chopper." In 2007 he joined SpaceX as the startup's first full-time "media guy" where he helped document and share the company's early efforts, including producing and directing live Falcon 1, Falcon 9 and Dragon mission webcasts, facility tour videos, as well as designing and producing flying model rocket kits of the company's Falcon 9 launch vehicles. His other film credits include "Who Killed the Electric Car?," "Revenge of the Electric Car," "Do You Trust This Computer?," and Discovery Channel's 2018 release "Above and Beyond: NASA's Journey to Tomorrow" celebrating the space agency's 60 years of incredible accomplishments. Roger currently writes and produces fiction and non-fiction content about diverse science, space, and technology themes relevant to the crew members of Spaceship Earth.

2019 AIAA LA-LV Annual Awards Dinner
Thursday, May 9, 2019
Recognizing Excellence in our Chapter

To be presented:
2019 Excellence Award
The James Wertz Scholarship
STEM Student Awards & Recognition
Recognition of 2019 Chapter Honorees
with featured presentation
The InSight Mission - Exploring the interior of Mars
by Sanford M. Krasner
End-to-End Information System Engineer and Entry Descent and Landing Communications Lead for the InSight mission, NASA Jet Propulsion Laboratory (JPL)

Click here for Information & Registration:
http://events.r20.constantcontact.com/register/event?oeidk=a07eg6dnyru64afd317&llr=p9tbt6cab

2018-2019 marked an exciting year for aerospace, especially for the Los Angeles - Las Vegas area! The recent successful and exciting powered human flights into space by the VSS Unity (SpaceShipTwo) (Virgin Galactic), the successful launch and mission of Mars InSight (NASA JPL/Lockheed Martin), Parker Solar Probe (NASA APL), and the TESS exoplanet mission (MIT/NASA Goddard) etc., caught great attention from many people in the world.

Human space travel is getting more and more realistic and affordable, with more and more discoveries and understandings for our and distant Solar Systems. There has also been great progress in student activities. Please join us, have fun, and:

Come to meet with Aerospace industry professionals with diverse backgrounds

Enjoy great food, dessert, and drinks while networking and fostering professional development opportunities

Learn more about recent achievements by local pioneering aerospace industries

Learn more about how to become an astronaut

Congratulate & recognize the award winners and celebrate their achievements

Learn more about STEM activities in AIAA / LA-LV Section to educate and inspire

Support & encourage students' STEM efforts, celebrate their accomplishment, and appreciate the efforts from the students and their teachers

Meet with the next generation- emerging high school students, student technical essay award winners and their teachers

Event Location
The Proud Bird (The Aviator Room, 1st Floor)
11022 Aviation Blvd
Los Angeles, CA 90045
(Free Parking)
(East of LAX & Pacific Coast Hwy 1, North of 105/Imperial Hwy, West of 405 Hwy, South of W. Century Blvd/Hwy 10)

Thursday, May 9, 2019, 5:00 pm - 9:45 pm
Ticket sales will end after Monday, May 6, 2019
Dress Code - Business or Business Casual
Contact events.aiaalalv@gmail.com or (949)426-8175 if any questions