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

Newsletter

May 2020

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AIAA LA LV Newsletter Editor
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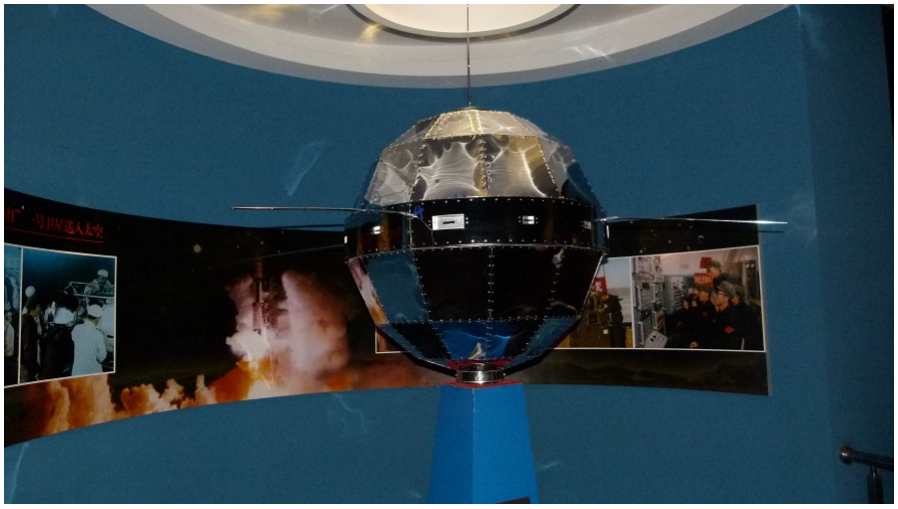
The East is Red – 50 Years of China in Space

by Mike Gruntman, Professor of Astronautics at USC, astronauticsnow.com



Dong Fang Hong I – first Communist Chinese satellite (1970) (from Wikipedia)

Fifty years ago, on 24 April 1970, the People's Republic of China launched its first artificial satellite into space.

Launching of an Earth-orbiting satellite was on the minds of the Chinese leaders early on. Mao Zedong (Mao Tse-tung) stated on 17 May 1958, at a meeting of the Communist Party Central Committee, "we shall develop our own artificial satellite" (China Today 1992, 20). Consequently, a special program was established by the Chinese Academy of Sciences, and the Institute of Machine and Electricity was formed in Shanghai to concentrate on the project. The focus of the effort, however, shifted a year later to more realistic objectives of establishing a sounding rocket program.

The Chinese satellite program included development of a space launcher and a spacecraft. The government started the program again in 1965, with significant resources behind it. The space launcher would become known as the Chang Zheng (Long March in English), or CZ-1 (LM-1), and the spacecraft would be called Dong Fong Hong (The East is Red in English), or DFH-1. This ambitious and politically important program was conducted during the bloody turmoil of the Cultural Revolution, which began in 1966 and lasted for 10 years. Many functionaries (cadres), managers, scientists, and engineers were persecuted, humiliated, harassed, banished, or murdered, in a familiar story repeated again and again in advanced Marxist countries.

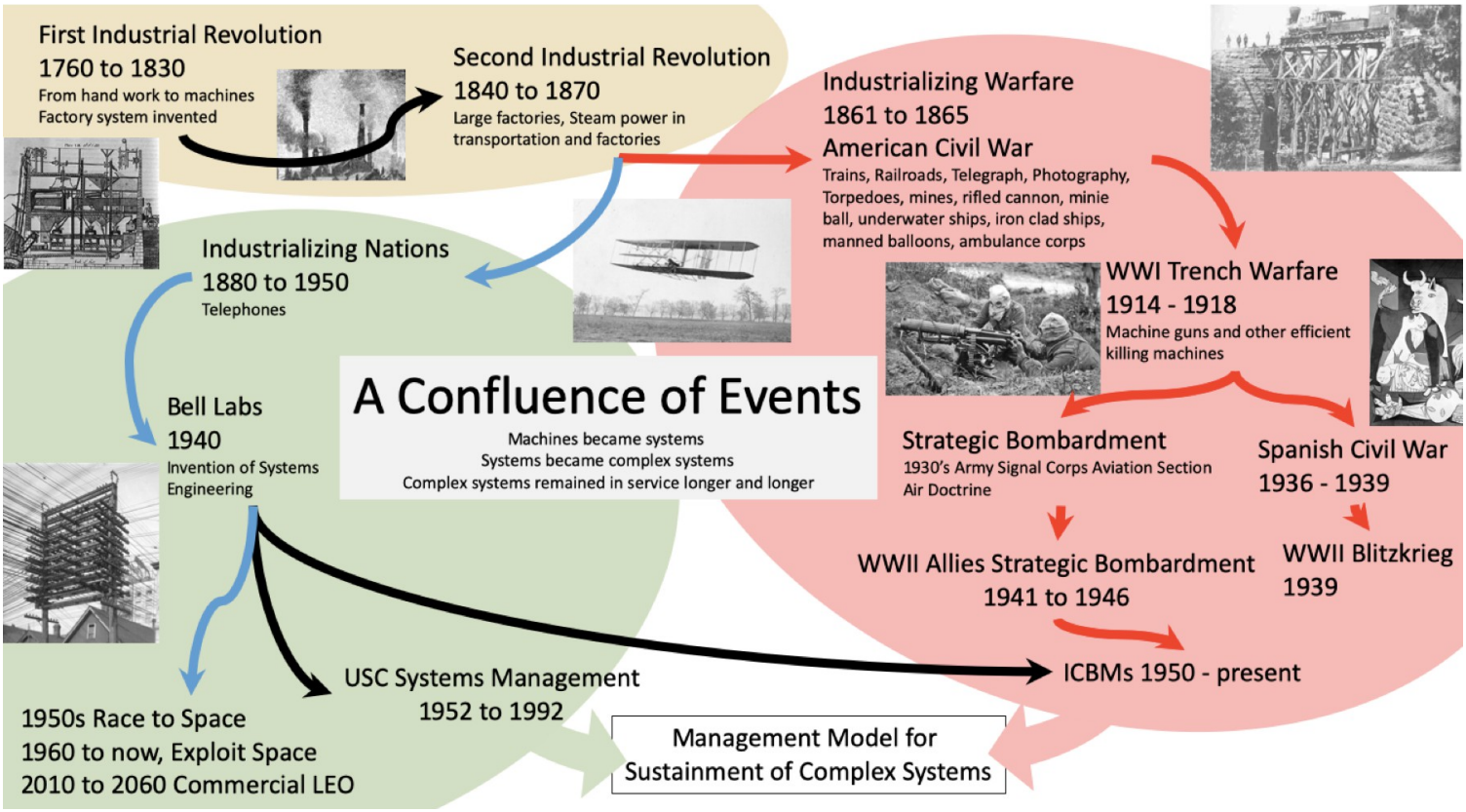
The Chinese Communist Party attached enormous propaganda importance to the satellite program. The original plan was to launch a satellite in an 80-degree azimuth direction. Such a near-eastward launch, taking advantage of the Earth rotation, would have placed the satellite in orbit with an inclination of 42 degrees. However, the country leaders

(Continued on Page 16)

https://www.linkedin.com/pulse/east-red-50-years-china-space-mike-gruntman/ (Authorized by the article author)

ICBM Sustainers Kept the Weapon System Effective for Decades

by Col. Charles Vono (USAF & TRW Retired), AIAA Distinguished Lecturer, AIAA Associate Fellow



History of Sustainment, for more on this, see charlesvono.com/presentations and publications to view my January 2019 paper "Mega Trends in Systems, Systems Engineering, and Sustainment." (Photo Courtesy of Charles Vono)

We ICBM sustainers have decades of experience using systems engineering to manage a very complex weapon system. These skills, and the way we combined them, can provide valuable lessons for people sustaining their own complex systems today, whether military or civilian.

The ICBM community in the mid-to-late 20th century was a tight-knit group, a fanatical mafia set apart from the common man (at least in our own minds). Our tribe worked together with a disciplined focus to support the most important mission in the world, nuclear deterrence.

Walls around the community included our own jargon, legitimate information restrictions (e.g. confidential, secret, top secret, NOFORN, official use only, & etc.), rare technical knowledge ("rocket science"), a sense of us against the rest of the Air Force, and even a desire from the common American citizen to not look too closely at very scary weapons.

These conditions made sharing our breakthroughs in the sustainment of complex systems with outsiders much less likely. Yet managers and sustainers, military and civilian, outside our mafia could benefit greatly from these breakthroughs.

This and the next few articles I will place in this newsletter will pass along this skill.

(Continued on Page 17)

COVID living as a proxy for life in space

by Brent Sherwood, Vice President, Advanced Development Programs at Blue Origin,
Chair of the AIAA Space Architecture Technical Committee (SATC) from 2018-2020

Brent Sherwood (Photo Courtesy of Brent Sherwood)

Romantic myth versus stark reality

Why do we think space travel is cool? Is it because humans long for the unattainable and are compelled by the mystique of traveling to exotic places? We tend to imagine our future in space as something wonderful, even magical. Many people vaguely romanticize space travel without thinking about it explicitly or often.

Space architects, by contrast, think about it constantly, at scales "from spoons to highways". We work to tame the discomfort, sensory disorientation, noise, odors, remoteness, tedium, and bodily risks of surviving, working, and living in space. This is essential work because someday, most of humanity may live in space: only the solar system's unlimited material and energy resources and lack of precious native ecology will allow humanity to expand far beyond today's billions.

But life in space will be quite strange compared to what Homo sapiens has always known. No open skies, outdoors, or air at all. Vast distances and high energies. Hyper-awareness of the mechanics of life, and the constant threat of quick death: these are the normal conditions of living in space.

Today, the COVID-19 pandemic is forcing a sudden, disorienting transformation in how we live. Our "new normal" brings us closer to space architecture than we might think.

Lessons from and for COVID living

Over 30 years ago[1], I explored some inescapable realities of eventual space settlements: 1) Free-space settlements will likely dominate planetary settlements, because of resource availability and astrodynamics. Settlements may be clustered, but such clusters will be extremely isolated from each other. 2) Transporting people between isolated locations will always be vastly more complex and expensive than transporting cargo. It will always be cheaper for people to reproduce where they are than to move them. 3) Vast distances will limit data streaming and preclude real-time conversations, and prevent political control from afar. 4) Survival will be catastrophically vulnerable to technical errors or willful sociopathy.

Interestingly, these same principles govern even very small-scale, contemporary space travel: 1) there will be more travel in low Earth orbit than to the Moon or Mars; 2) cargo launch is expensive, but human space flight even more so; 3) travelers' connectedness, psychology and sociology are dominated by remoteness; 4) preventing and correcting mechanical failures is a vital, ever-present concern.

Distanced living

As we're learning from COVID, social distancing is hard for social animals – it feels deeply unnatural. Social pressure to relax distancing rules built quickly, for economic reasons but also because of how imprisoning it feels to be stuck in isolated little pockets, unable to mix freely.

Lockdowns have collapsed our access to spatial variety – now instead of the rich sensory and haptic experience of moving to and through diverse places, we view the world on screens. In dense urban settlements, many people are confined in small apartments with limited views.

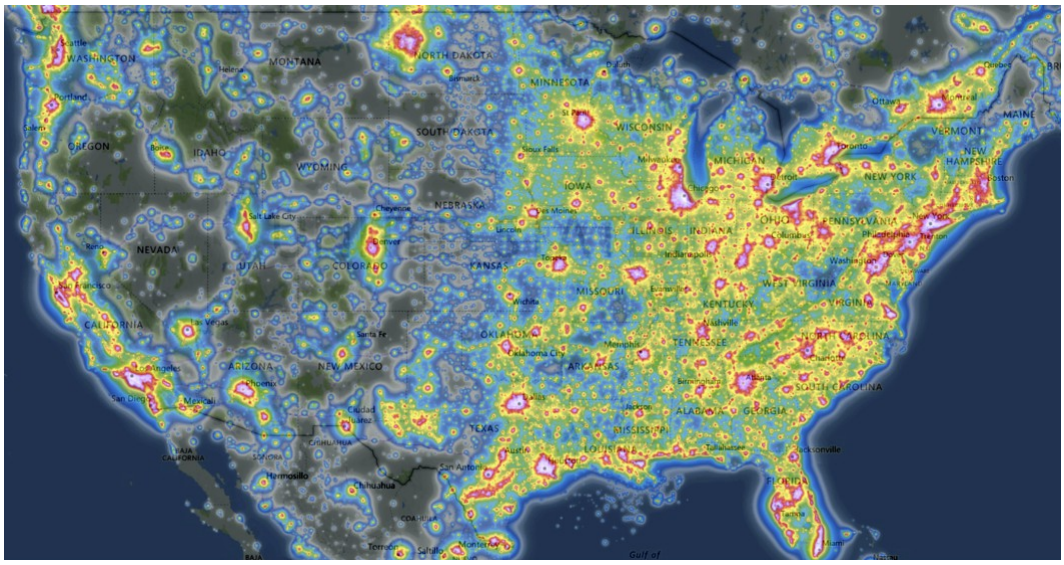
Our face-to-face social circles have also collapsed, essentially to family. Other people, whose behaviors we can't observe and control, have become truly "other", each one a potential existential threat. This strongly reshapes many behaviors; for example, monogamous dating suddenly appears essential.

(Continued on Page 18)

1) Sherwood, B. Offworld diversity: the branching of life in space, in Didsbury, H.F. (ed), *The Future: Opportunity not Destiny*, World Future Society, Bethesda, Maryland, 1989. ISBN 0-930242-36-X.

Connecting to space through dark night skies

by John Barentine, Ph.D., Director of Public Policy, International Dark-Sky Association (IDA)



The predicted brightness of the night sky at the zenith across the continental United States derived from satellite measurements obtained in 2015. Progressively warmer colors indicate brighter night skies. Image courtesy of NASA/NOAA/Jurij Stare (www.lightpollutionmap.info); Microsoft Bing basemap reprinted with permission from Microsoft Corporation. (Photo Courtesy of John Barentine)

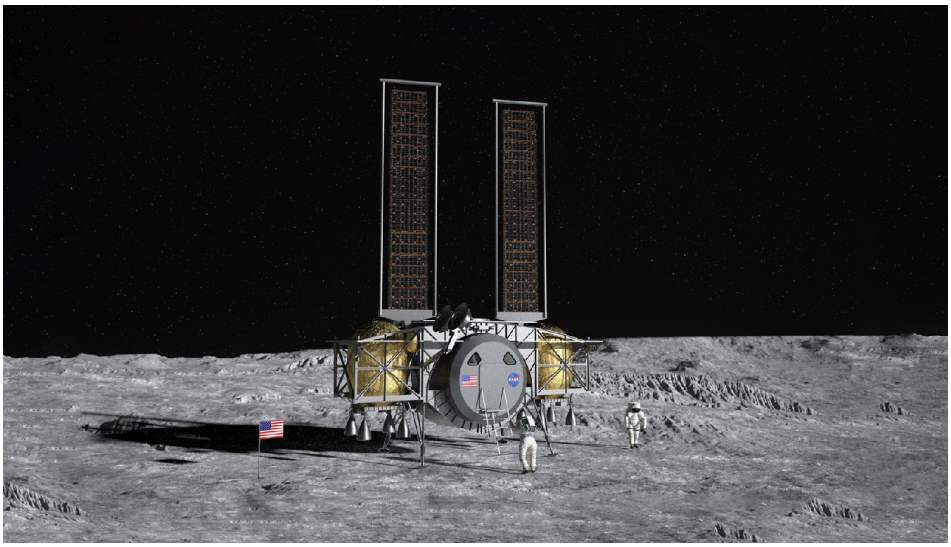
The International Dark-Sky Association (IDA) is a 501(c)(3) nonprofit organization founded in 1988 to preserve and protect the nighttime environment and our heritage of dark skies through environmentally responsible outdoor lighting. It aims to reduce light pollution around the worldly promoting recognized best practices in outdoor lighting design, installation and operation. IDA works in four broad programmatic areas to achieve its mission: technical, conservation, public policy and advocacy. We leverage a distributed network of over 3,000 members and advocates across the globe to build public support for the active conservation of natural nighttime darkness where it still exists, and the rehabilitation of the nocturnal environment where it has been impacted by the use of artificial light at night (ALAN).

We pursue these goals because it has become increasingly evident in the past decade that ALAN has many adverse impacts on our world that extend far beyond whether or people are able to see the stars. These include known and suspected harms to wildlife, public safety, energy security, climate change, and even human health. In addition to the threat it poses to the environment, light pollution represents a waste of financial resources; IDA estimates that poorly designed and installed residential outdoor lighting alone costs Americans somewhere between $1.4 to $3.5 billion a year in energy. Society therefore stands to gain much by solving this problem, and it can be solved immediately and efficiently simply by thinking different about the ways we use outdoor ALAN. Once we choose a different outcome and improve outdoor lighting, this form of environmental pollution resolves itself literally at the speed of light. We can realize a better result while saving money, improving nighttime visibility, and preserving public safety.

IDA is present and involved in all AIAA Regions. Region VI (Western) is of particular interest, because the western states contain the country's largest remaining reservoirs of natural nighttime darkness (Figure 1). Partnering with agencies such as the U.S. National Park service, IDA has certified 50 Region VI sites in its flagship International Dark Sky Places Program, and it has chapters and delegates in each of the Region VI states. IDA also works with public and private land managers in the region, such as the Bureau of Land Management and various state parks systems, to promote dark-skies conservation best practices. And for over 20 years, IDA has engaged the lighting manufacturing industry, both in the U.S. and abroad, through its Fixture Seal of Approval program to design, produce and market better outdoor lighting products.

(Continued on Page 19)

Astrobotic to Develop New Commercial Payload Service for NASA's Human Landing System (4 May, 2020) *(with Permission from Astrobotic Inc.)*



HUNTSVILLE, Ala. - Dynetics, a wholly owned subsidiary of Leidos (NYSE: LDOS), has been awarded a contract under NASA's Artemis program to design a Human Landing System (HLS) and compete to build a system to take the first woman and next man to the lunar surface by 2024. (Credits: Dynetics website)

Astrobotic tapped by Dynetics, one of three awardees under the NASA Human Landing System Program, to develop and lead commercial lunar payload sales and integration onboard their new large lander capability

Pittsburgh, PA – Astrobotic proudly announces that it is has been selected to develop and lead a new commercial payload service onboard the Dynetics Human Landing System (HLS). Dynetics, a wholly owned subsidiary of Leidos, was recently announced as one of three awardees by NASA to develop a new commercial lunar lander for NASA's Artemis Program. The design and development of HLS for Artemis will land the first woman and the next man on the Moon by 2024. With this new approach, the human lander will not only carry astronaut crews but also commercial payload shipments.

"As the leading lunar payload delivery provider, we are thrilled to begin setting up this new sales offering onboard the Dynetics human lander," said Astrobotic CEO, John Thornton. "With payload expertise from our Peregrine and Griffin lunar lander programs, Astrobotic is now poised to extend our payload services to include the Dynetics human lander. This is another important step in commercial lunar development."

Astrobotic's multi-year experience in lunar payload integration across 16 payload deals to date will now be leveraged to bring payloads onboard the Dynetics' human lander from companies, governments, universities, and non-profits. Astrobotic will become the front door service for organizations around the world to send their payloads to the Moon on this new lander. Astrobotic will assist payload customers in successfully integrating with the human lander in preparation for launch and subsequent operation on the Moon.

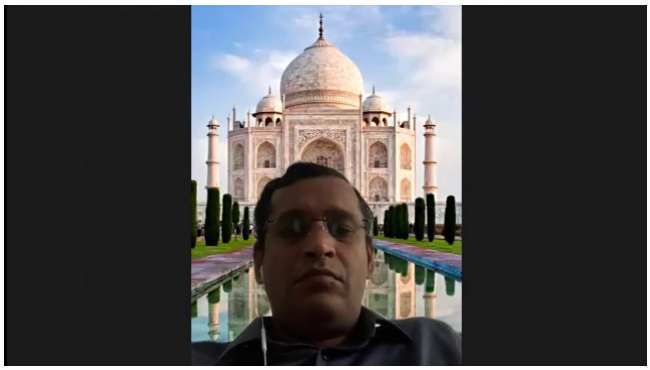
"Dynetics is excited to lead this expert team of subcontractors that will return Americans to the lunar surface," said Kim Doering, Vice President of Space Systems at Dynetics. "This team has a proven history of technical excellence, and their contributions will greatly benefit the future of space exploration."

About Astrobotic

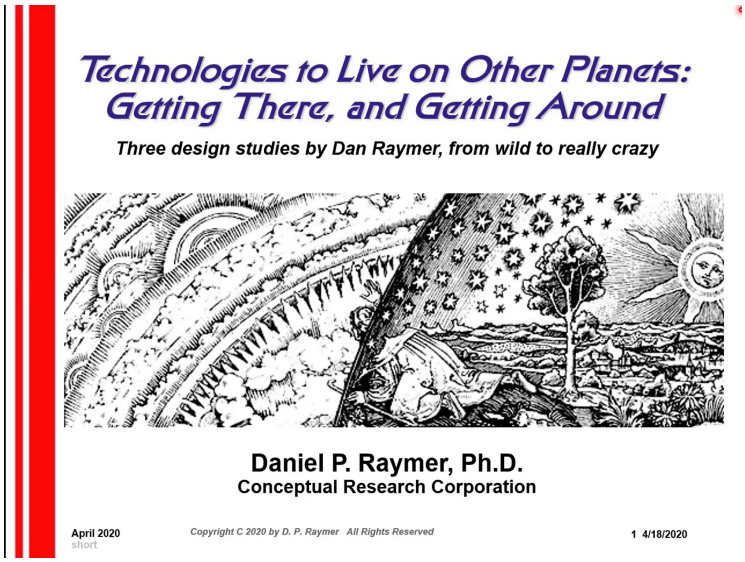
Astrobotic Technology, Inc. is a space robotics company that seeks to make space accessible to the world. The company's lunar lander, Peregrine, delivers payloads to the Moon for companies, governments, universities, non-profits, and individuals for $1.2 million per kilogram. Astrobotic was selected by NASA in May 2019 for a $79.5 million contract to deliver payloads to the Moon in 2021. The company is also developing advanced space robotics capabilities such as terrain relative navigation, mobile robotics for lunar surface operations, and reliable computing systems for mission-critical applications. The company also has more than 30 prior and ongoing NASA and commercial technology contracts, a commercial partnership with Airbus DS, and a corporate sponsorship with DHL. Astrobotic was founded in 2007 and is headquartered in Pittsburgh, PA. ***(Mr. John Thornton will present on July 11 with AIAA LA-LV. (conta.cc/2SvGyx7))***

AIAA LA-LV New Space mini-Conference 2020 (18 April, 2020) *(Photos Only)*

aiaa-lalv.org/aiaa-la-lv-new-space-mini-conference-2020-online/ (Information & Video)



Dr. Chandrashekhar Sonwane, the Section Chair of the AIAA LA LV Section (with a virtual Taj Mahal background) on Zoom, gave the Welcome Message and Introduced John Rose (the AIAA Region VI Director), who gave his Welcome Message and COVID-19 on aerospace status update through dial-in by phone, and the Inaugural Presenter, Dr. Daniel P. Raymer. (Zoom Screenshot)



Cover page of the Inaugural Presentation by Dr. Daniel P. Raymer.

AIAA LALV New Space mini-Conference 2020

* And it's highly recommended please only use the telephone dial in if you are associated with a defense project or contractor. And Please don't talk about any sensitive business, national security, or personal information/private issues over the phone dial-in or on the Zoom online session

Moderators: Dr. Chandrashekhar Sonwane (before 10:15 AM), Mr. Jay Gallertine (before 1:35PM) and Ms. Beth Mund (before 5:20 PM)

09:00 AM Dr. Chandrashekhar Sonwane (Welcome)
09:05 AM John Rose, AIAA Region VI Director (Welcome and COVID-19 Impacts on Commercial Aerospace)
09:15 AM Dr. Daniel P. Raymer (Inaugural Presentation)
10:15 AM Shawn Boike, Insta-Grid.com (Space Force)
10:55 AM Prof. Joyce Liao, MD/ Ph.D. (Stanford Univ. Medical School) (Eye-brain issues in microgravity and the effect of hypoxia in COVID-19 infection

AIAA LALV New Space mini-Conference 2020

11:35 AM Fred Lawler (Raytheon) (Resume Workshop and Interview Skills)
12:15 PM Matthew Kuhns (Masten Space Sysems)(Lunar (Artemis) activities and Additive Manufacturing)
12:55 PM Marty Waldman (SIL, AIAA Las Vegas, NDIA S. NV (Aerospace activities in the Clark County)
1:35 PM Moises Seraphin and Brett Cornick (Challenges faced by future Generation)
1:55 PM Jennifer S. Perdigao and Jared Schneider (Tressler LLP)(Space Junk Liability)
2:35 PM Erik Jessen (Raytheon) (Agile and Extreme Programming)
3:15 PM Frank Czopek (A Pre-History of GPS)
3:55 PM Larry A. Trager and Dr. Cheng-Yi Lu (Aerojet-Rocketdyne Space Station Power Systems)
4:40 PM Dr. Seth Potter (Orbit Options for Near-Term Space Solar Power)
5:20 PM Adjourn

The agenda was presented in the very beginning of the event.

Dr. Daniel P. Raymer (AIAA Fellow) gave a fun and informative talk, which also included the first-ever public talk about his Mars Plane Design. (Zoom Screenshot)

Mr. Shawn Boike (insta-grid.com) explaining the important and exciting development of the U.S. Space Force. (Zoom Screenshot)

(Continued on Page 20)

AIAA LA-LV e-Happy Hour (24 April, 2020) *(Photos Only)*

https://aiaa-lalv.org/e-happy-hour-on-april-24-2020 (Video and more information)

Mr. Brett Cornick moderating this e-Happy Hour, with a grandiose virtual background of planet systems with rings. (Screenshot)

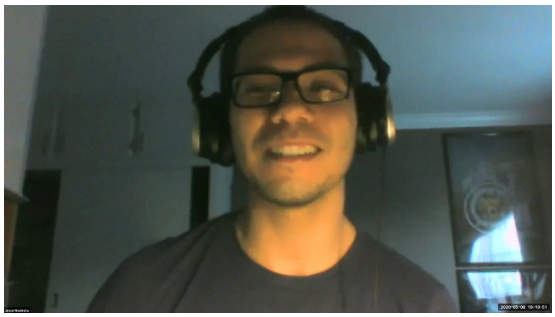
Dr. Don Black shared his views on the career development during the COVID-19 pandemic. (Screenshot)

Mike Makowski (AIAA Phoenix) shared his experiences and stories in aerospace careers. (Screenshot)

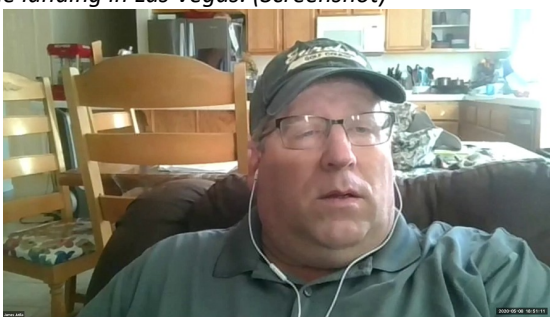
Mr. Scott Fouse joined the chat and enjoyed the conversations with the fellow attendees. (Screenshot)

AIAA LA-LV e-Happy Hour (8 May, 2020) *(Photos Only)*

Marty Waldman leading the aerospace discussion and sharing his exciting encounters and stories about the 100th Anniversary of the first plane landing in Las Vegas. (Screenshot)



Jesse Modesto (AIAA Cal-Poly Pomona, 2019, volunteering for AIAA LA-LV), sharing his excitement about aerospace, & asking questions about others' aerospace suggestions & experiences. (Screenshot)

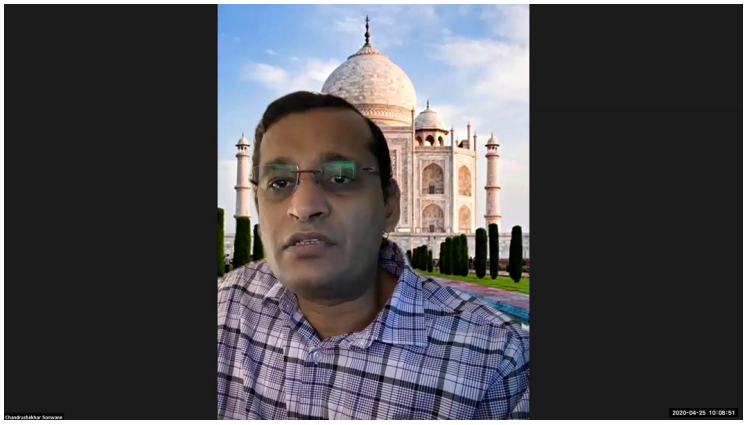


James Jutila shared his story about X-15 and his STEM K-12 experiences, along with some career development thoughts.

Dr. Seth Potter talking about his career experiences and commenting on rockets in the virtual background behind him.

AIAA Los Angeles Las Vegas and SCALACS joint Earth Day e-Town Hall Meeting (25 April)

(Photos Only) *aiaa-lalv.org/april-25-2020-aiaa-los-angeles-las-vegas-and-scalacs-joint-earth-day-e-town-hall-meeting/*



Dr. Chandrashekhar Sonwane, the AIAA LA LV Section, welcoming the audience online with the virtual Taj Mahal background. (screenshot)

Prof. Madhu Thangavelua (moderator) starting his presentation with an impressive Earth Day picture with an Earth / Sunrise view.

AIAA

AIAA LALV & SCALACS April 25 Earth Day 50th Anniversary

10:05 AM: Welcome & Introduction by Dr. Chandrashekhar Sonwane
Chair of AIAA LALV Section & EPA Scientific Advisory Board member
10:10 AM: Welcome by Dr. Brian Brady, Chair of SCALACS
10:15 AM Prof. Madhu Thangavelu, USC (Space and City: Lessons from the Future)
10:35 AM Prof. Sachdev Sidhu, Molecular Genetics and the Donnelly Centre at the University of Toronto (COVID-19 Therapeutic Development in Real Time: Roadblocks and Opportunities)
11:15 AM Brett Cornick (Challenges faced by future Generation)
11:25 AM Erik Jessen, Raytheon (Management Theory and Leadership)
12:05 PM Dr. João Teixeira, Co-Director, Center for Climate Sciences, NASA JPL (The Climate of the 21st Century from Space)
12:45 PM Panel Discussion on How to Protect and develop the Earth for a better future (moderated by Prof. Madhu Thangavelu)
Prof. Madhu Thangavelu, Dr. João Teixeira, Prof. Sachdev Sidhu, Dastan Khalili (15 min talk), Jane Poynter and Taber MacCallum (15 min talk), Marty Waldman, Prof. Craig Smith
1:45 PM Nuclear is the only true Renewable Energy Source, a Case Study in Nevada (Marty Waldman and Craig Smith)
2:45 PM Adiourn

Agenda for the AIAA LA LV Earth Day event on 25 April, 2020.

Prof. Madhu Thangavelua (moderator) presenting his research & concepts in Space Architecture. (Screenshot)

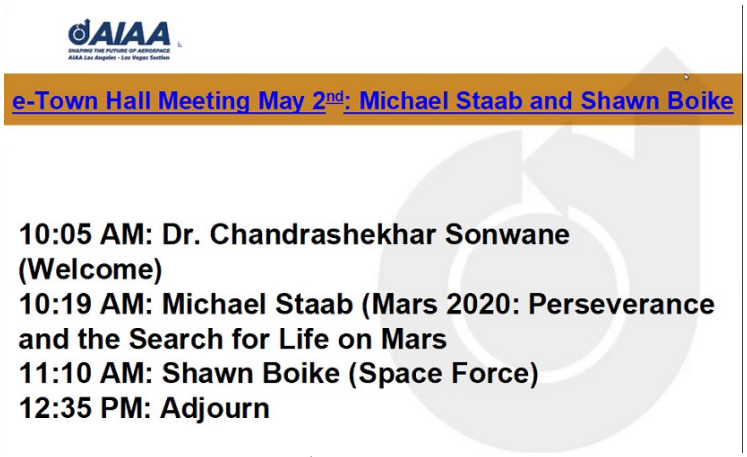
Dr. Brian Brady (Aerospace Corp.), Chair of SCALACS, welcoming the attendees, along with Dr. Sonwane. (screenshot)

Prof. Sachdev Sidhu (University of Toronto) presenting his research and promising new treatment for COIVID-19. (Screenshot)

(Continued on Page 21)

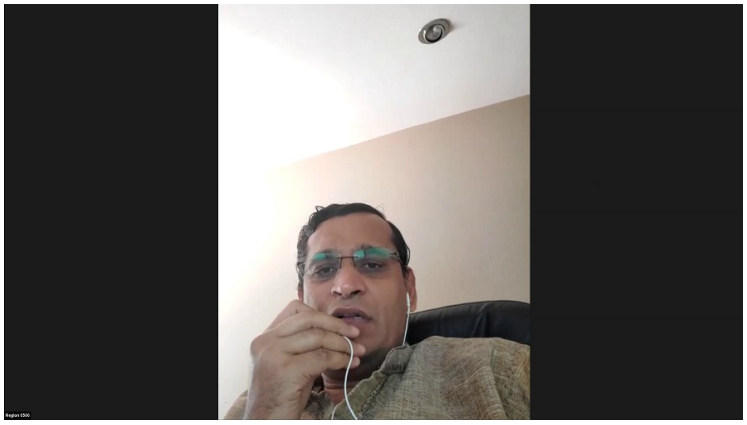
AIAA LA-LV e-Town Hall Meeting (2 May, 2020) with Michael Staab / Shawn Boike
Mars 2020: Perseverance and the Search for Life on Mars / U.S. Space Force (USSF)

(Photos Only) *aiaa-lalv.org/may-2-20202-aiaa-la-lv-e-town-hall-meeting-with-michael-staab-and-shawn-boike/*



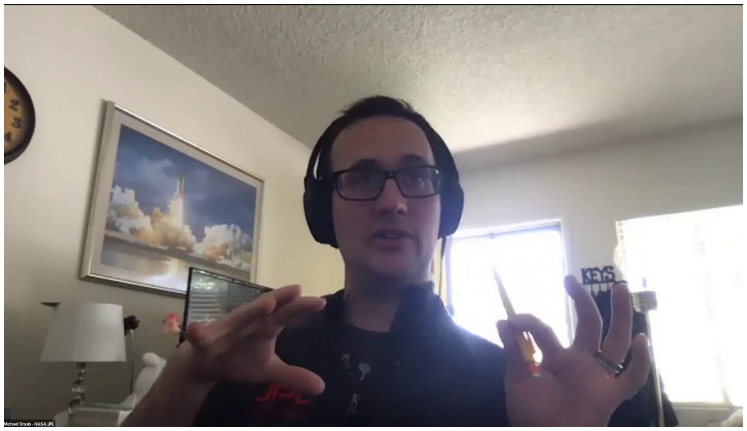
Agenda for this May 2nd e-Town Hall Meeting. (Screenshot)

The Mars 2020 Mission will be launched in the summer (July most likely) of 2020, and the Perseverance Rover will arrive / land on the Martian surface in 2021. (Screenshot)



Dr. Chadrashekhar Sonwane, AIAA LA LV Section Chair, giving the welcome message, and introducing the 2 speakers, Michael Staab and Shown Boike. (Screenshot)

The speaker, Michael Staab, describing the new camera on the Perseverance Rover. (Screenshot)



The speaker, Michael Staab, answering questions from the audience about the new features on the Perseverance Rover in the Mars 2020 Mission. (Screenshot)

The Mars 2020 Rover looks a lot alike the MSL / Curiosity Rover, according to the speaker, Michael Staab. (Screenshot)

(Continued on Page 22)

MAUREEN ZAPPALA: EXPOSING THE IMPOSTOR SYNDROME

By Douglass M. Stewart, Jr., Producer/Writer/Director - "Chesley Bonestell: A Brush With The Future"
aiaa-lalv.org/may-9-2020-e-town-hall-meeting-with-guest-speakers-maureen-zappala-and-frank-czopek/

Are you one of those people who are used to having your projects turn out successfully but has a tough time accepting your part in the success? Do you fear that people secretly doubt your role in why things turned out so well? Could you be afraid that people think you are not who you say you are… in other words, that you're a phony? If any of this rings true, you could be suffering from what is called "Impostor Syndrome"- and you believe that you are the impostor. In a fascinating talk given to AIAA LA-LV members, author, professional speaker and engineer **Maureen Zappala** delved into the depth and breadth of Impostor Syndrome and how to handle it. "Impostor Syndrome," said Maureen, "is the chronic fear of being found out as a fraud. It's the secret self-doubt that strikes smart, skilled and successful people and makes them think they are not smart, skilled and successful. In fact, Impostor Syndrome is the single biggest factor that keeps many engineers from advancing professionally and truly enjoying their careers." This condition, which is actually quite common, takes a lot of joy out of work and indeed, one's own life. It's estimated that 70% of people suffer from Impostor Syndrome. Maureen would know because she has successfully dealt with that condition herself.

Her career was off to a dynamic start when she became the youngest and first female manager of the Propulsion Systems Laboratory, a jet engine test facility at NASA Lewis Research Center in Cleveland (now the NASA Glenn Center). Back then, Maureen worried about what people were thinking of this young, inexperienced woman who somehow landed an important job at a very specialized NASA facility. She described an amusing incident that took place in a tightly packed control room during a critical engine stall recovery test. Confident that she was safely hidden behind her console, she suddenly started hiccupping. "You can only imagine how horrified I was when all 18 heads belonging to rock star engineers and scientists all swiveled around to look at me." She felt sure that this was the end of her short-lived career but it prompted her to begin the inner quest for what was troubling her. Eventually, she found it and it was called Impostor Syndrome. During her talk to the AIAA-LA/LV Section, she expounded on the effects, the symptoms and the solutions of how to break out of it. "You can be released from this experience so you can quiet that impostor voice. You can begin to enjoy your success, be proud of your abilities, and confidently face new opportunities without fear of being unmasked as a fake."

Maureen walks her own talk and has an important message for companies and organizations: "Impostor Syndrome can also cost a company time, revenue and opportunities. It leads to poor performance, employee disengagement, and high turnover," she warns. Her mission these days is to change people's lives in the ways that she was able to successfully change hers. These changes also bring about positive results in the workplace. She's earned her stripes as an acclaimed motivational speaker and is the author of four books including "Pushing Your Envelope: How Smart People Defeat Self-Doubt and Live with Bold Enthusiasm." To learn more about Maureen and the Impostor Syndrome, you can visit her website: https://maureenz.com/

Maureen Zappala

Keynote Speaker, Author, Presentation Skills Coach

Founder, High Altitude Strategies

2017-18 President, National Speakers Association, Ohio Chapter

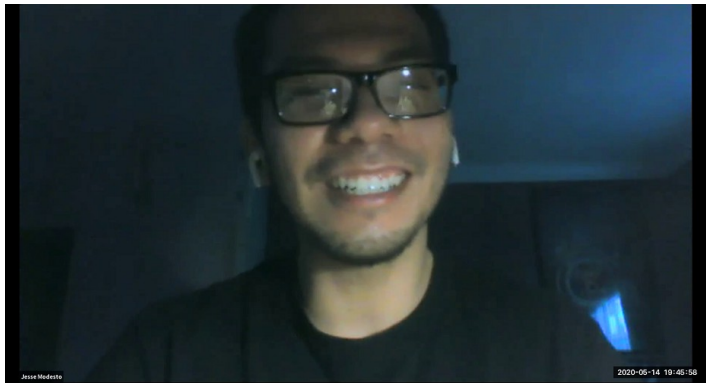
Podcast host of "No Doubt Allowed"

AIAA LA-LV Young Professional (YP) e-Happy Hour (14 May, 2020)

by Jesse Modesto (AIAA Cal Ploy Pomona, 2019)

Moises Seraphin (AIAA LA-LV YP Chair), leading and moderating this e-Happy Hour, also sharing some of the resume & interview tips he talked about during the Career Workshop on 16 November, 2019 (conta.cc/2nIsmUS). (Screenshot)

Aiden Bramer (an AIAA member), asking a question about the effect of inhomogeneous gravity field distribution on delta-V and chatting with fellow attendees on other interesting aerospace topics and news. (Screenshot)



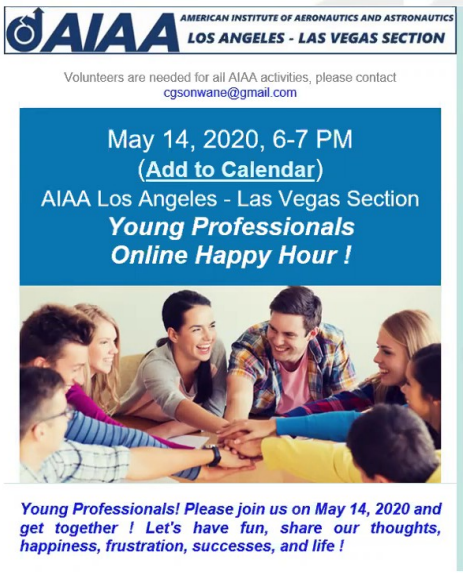
Jesse Modesto (AIAA Cal-Poly Pomona, 2019, volunteering for AIAA LA-LV), chatting with Moises and other attendees about orbital mechanics, perturbations, careers, jobs, and aerospace news. (Screenshot)

Here are the notes from Jesse:

"The May 14th YP event was excellent. On the Young Professionals Happy Hour Zoom meeting numerous individuals spoke about their current impact through Covid-19, the current state of the aerospace industry as we know it and what we can expect to see happen in the coming months. A few attendees asked questions regarding, "How best to search for a job". The host, Moises Seraphin, talked about his experience with seeking jobs and completing job applications. He explained that at one point he had 3 resumes: one that emphasized his aerospace engineering experience, one that was more general that included his work in ocean engineering, and lastly one that emphasized his mechanical engineering skills and past ME internships. "Finding a job was very difficult. I just so happened to graduate during one of the industries down turns; Budget Cuts", he said as he continued to discuss how at that time finding a job was critical in paying back student loan debt and rent. Fortunately, Moises was given the opportunity to work for in an Applications Engineer role in Virginia, and now works as a Field Engineer for a Swiss manufacturer in Southern California. His success is an excellent example of why job applicants should tailor their resumes to each job they apply for.

As the meeting went on, members talked about their experience with COVID-19. While some places were laying people off in great numbers, members also talked about how many other places were having hiring surges!

We would also like to thank Moises for hosting this event. As the virus continues to impact us, this event was an opportunity for members to talk about their problems and to seek advice during these troubling times."



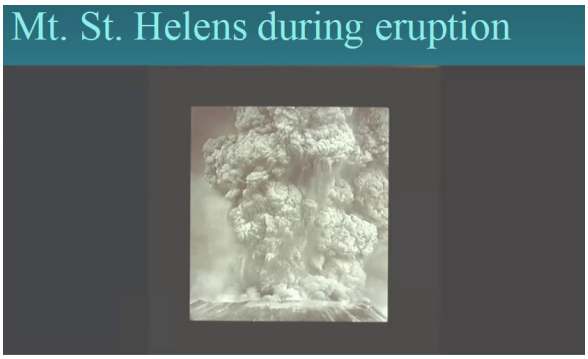
Email notice / reminder for this May 14 Young Professional (YP) e-Happy Hour.

(Aero Alumni) Effects of Volcano Ash on Aviation 40 Years after Mt. St. Helens (20 May, 2020) *(Photos Only)*

aiaa-lalv.org/aero-alumni-effects-of-volcano-ash-on-aviation-40-years-after-mt-st-helens-on-may-20-2020/

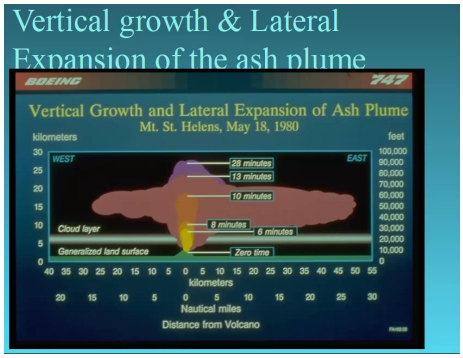
Gary Moir speaking and moderating the discussion. (Screenshot)

Guido Frassinelli making some comments. (Screenshot)



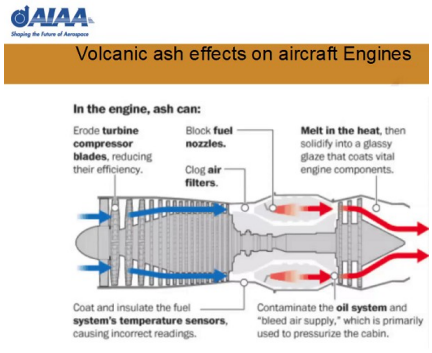
Mt. St. Helens eruption photo presented by Gary Moir. (Screenshot)

Mr. Crawford indicating some interesting points. (Screenshot)

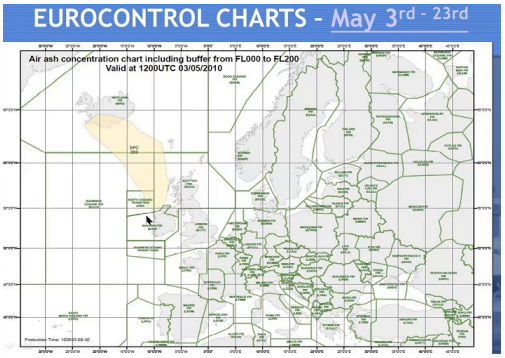


Ash plume expansion presented by Gary Moir. (Screenshot)

Mr. Ken Pauley sharing his own observations. (Screenshot)



Volcanic ash effects on aircraft engines presented by Gary Moir. (Screenshot)

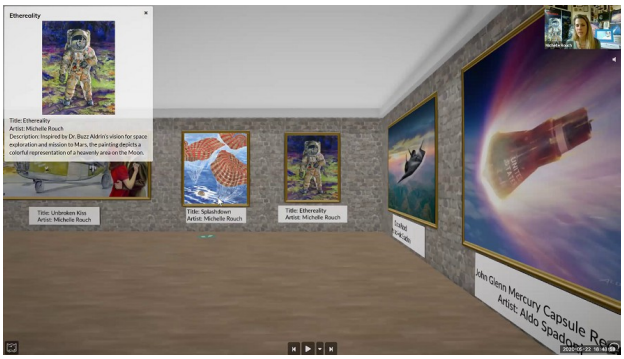


An attendee asking about the area marked yellow in the Euro Flight Control Charts during Mt. St. Helens' eruption in Gary Moir's presentation. (Screenshot)

e-Gallery Reception / e-Happy Hour (22 May, 2020) Meet the Artists for the First-Ever AIAA LA-LV Virtual Gallery Aerospace Art Exhibition (May 9 – July 11): Michelle Rouch, Mark Pestana, and Aldo Spadoni *(Photos Only)*

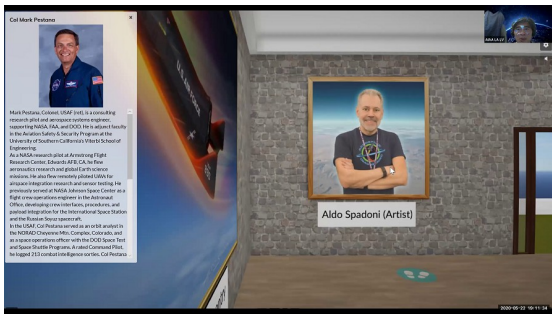
https://aiaa-lalv.org/may-22-2020-e-happy-hour-e-gallery-reception-meet-the-artists-michelle-rouch-mark-pestana-and-aldo-spadoni/

Entrance of the First-Ever AIAA LA-LV Virtual Aerospace Art Museum/Gallery event, Grand Opening, with TV walls showing the AIAA promotional video (with audio) for the AIAA ASCEND. Left: Dr. John S. Langford, III, President of AIAA; Right: Dr. Sandra Magnus (ISS Astronaut), former Executive Director of AIAA. (Screenshot)



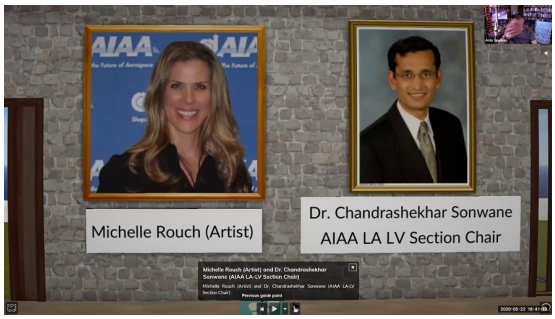
Walk-through in the virtual Aerospace Art Gallery to appreciate, enjoy, and view the exhibition (6 master pieces for each) of those 3 renowned Aerospace Artists, who are also AIAA members and Engineers. (Screenshot)

Aldo Spadoni (moderator) from his studio. Cheers! (Screenshot)



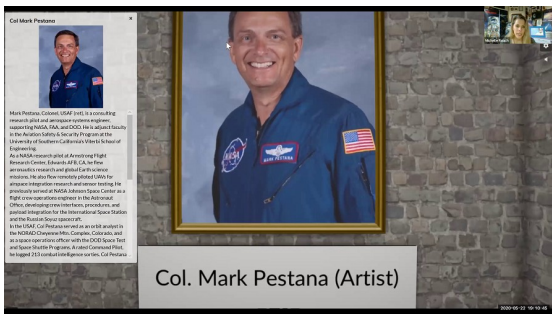
Aldo Spadoni (Portrait, Center) in the Gallery. (Screenshot)

Michelle Rouch from her studio. Cheers! (Screenshot)



Michelle Rouch (Portrait, Left) in the Gallery. (Screenshot)

Col. Mark Pestana from his studio. Cheers! (Screenshot)



Col. Mark Pestana (Portrait, Center) in the Gallery. (Screenshot)

(Continued on Page 23)

Crew Dragon DM-2 and First Flights: A Historical Perspective (23 May, '20) with authors from the Outward Odyssey series of spaceflight history books: (Michelle Evans) Francis French, David Hitt (Moderator), Richard Jurek, Emeline Paat-Dahlstrom, Melvin Croft, Geoffrey Bowman, and Chris Petty

(Photos Only) aiaa-lalv.org/may-23-2020-e-town-hall-meeting-crew-dragon-dm-2-and-first-flights-a-historical-perspective/

Welcome Message & Introduction; free 1-year trial e-membership.

The Moderator / Panelist, David Hitt. (Screenshot)

Agenda. This event is part of the DM-2 launch party.

DM-2 Astronauts Douglas G. Hurley and Robert L. Behnken.

Approximate subtopics assignment for panelists.

#Launch America as shown in the DM-2 introduction video.

Why Join AIAA? (Slides suggested by Fred Lawler)

Introduction video jumping start the event on May 23rd.

(Continued on Page 24)

March 05, 2020: Spy Pilot, Francis Gary Powers, the U-2 incident, and a Controversial Cold War Legacy

by Mingyi Chen, Mechanical Design Engineer, ProCustom Group

Francis Gary Powers Jr. speaking to the excited audience on March 5th, 2020, in the local aerospace icon, the Proud Bird. (Photo Courtesy of Ken Lui)

It's not too often the younger generation gets to hear about the Cold War, an era seemingly distant and irrelevant. But on March 5th, I had the fortune of learning about the famous U-2 incident in the history books from the descendant of the pilot himself. Surrounded by leaders and well-known figures in the aerospace industry at the AIAA Los Angeles-Las Vegas Dinner Event, held at the Proud Bird, I witnessed the story of a hero surrounded in controversy come to life.

ABOUT THE SPEAKER

Francis Gary Powers Jr., author and son of the famous aviator Francis Gary Frank Powers, is the founder and chairman emeritus of The Cold War Museum located in Vint Hill, Virginia, near Washington D.C. He started the museum in 1996 to honor Cold War veterans, preserve Cold War history, and educate the future generations about the time period. As chairman of the Presidential Advisory Committee for the Cold War Theme study, he works with the National Park Service and leading Cold War experts to identify historic Cold War sites for purposes of commemoration, interpretation, and preservation. He served as a technical advisor for the Steven Spielberg film project Bridge of Spies, the story of James Donovan, played by actor Tom Hanks. Donovan had brokered the 1962 spy exchange between Soviet spy Rudolf Abel and Frank Powers. He lectures internationally and appears regularly on the History, Discovery, and A&E Channels.

Francis Gary Frank Powers became a leading international figure overnight when the U-2 spy plane he was piloting was shot down by Soviet missiles on May Day 1960. He was captured immediately by the KGB, subjected to a show trial, and imprisoned. The Soviets eventually released him in exchange for Rudolf Abel, a KGB spy. However, when Powers returned to the U.S., while he was exonerated of any wrongdoing while in Russia, controversy about Powers lingered due to unfavorable press and the lack of defense from the government until his untimely death in 1977.

Francis Gary Powers, Jr. started by describing his childhood and growing up in the shadow of his father. His father passed away when he was just 12 years old, yet he found out about it by coming home and learning about it on the evening news, not by word of mouth. Powers Jr. became introverted in high school, and when he came out of his shell in college, he was curious to find out more about his father and the mystery that surrounded the whole U-2 incident. The more he learned from family, the more questions he had. From there, it took 25 years of research to uncover the whole story of his father.

engage.aiaa.org/losangeles-lasvegas/viewdocument/march-5-2020-spy-pilot-francis-g

(Continued on Page 25)

The East is Red – 50 Years of China in Space *(continued from Page 1)*

wanted the satellite to be literally "seen and heard" throughout the world. The spacecraft was designed to transmit a melody, "Dong Fong Hong," celebrating China's love for Chairman Mao and sending worldwide the inspiration of his invincible Communist thought. Therefore, the orbit inclination was ordered to be changed to 70 degrees (and launch azimuth to 160 degrees) to make the satellite visible in Europe and North America. The achieved orbit inclination would be 68.4 degrees.

After separation, the third rocket stage was to stay in orbit traveling close to the satellite. The satellite visual magnitude was estimated to be m = +5 to +8, barely visible to the naked eye under the most favorable conditions. The bigger third stage was expected to be somewhat brighter with magnitude m = +4 to +7. To make the third stage more visible to the naked eye, a special skirt was added to it, increasing its brightness by two levels of visual magnitude.

The first Chinese satellite, DFH-1, was successfully launched into orbit from the Jiuquan missile range on 24 April 1970. The achieved orbit perigee was 439 km (273 miles) and apogee 2384 km (1482 miles).

The official state Hsinhua (Xinhua) News Agency announced the successful launch of the satellite on the afternoon of the next day, starting celebrations across the nation.

As Peking Review (6, 1970) wrote, "… When the earth satellite radiant with the brilliance of Mao Zedong Thought passed over the capital of the great motherland, the whole city was thrilled."

The DFH-1 satellite was a spherical polyhedron 1 m (3.3 ft) in diameter with mass 173 kg (381 lb). It carried batteries and a radiotransmitter with the "melody device." The spacecraft was spun up with the third stage to 180 rpm during the launch. After separation, the centrifugal forces spread four 3-m telescopic antennas (folded during the launch) in the radial direction, reducing the spinning rate to 120 rpm.

The 3-W transmitter sent radio signals at the 20-MHz frequency. The Dong Fong Hong melody, after which the satellite was named, was broadcast for 40 s. Then, after a 5-s interval, telemetry was transmitted for 10 s. Following another 5-s interval, the cycle repeated itself.

The first stanza of "Dong Fong Hong" (The East is Red)

Red is the east, rises the sun.

China has brought forth a Mao Zedong.

For the people's happiness he works,

hu erh hai yo,

He's the people's liberator.

Thus, the People's Republic of China became the fifth country in the world to launch its own satellite on a national space launcher.

Today, the satellite orbit perigee is 431 km (268 miles), and apogee is 2032 km (1263 miles).

(Based, in part, on M. Gruntman, Blazing the Trail, 2004, pp. 238-446)

ICBM Sustainers Kept the Weapon System Effective for Decades *(Continued from Page 2)*

Let's start by looking at the history of ICBMs.

In the 1950's, the realization that ICBMs must be managed from a "systems engineering" standpoint was inherent in the ICBM program from the very beginning. When General Schriever began the program, he sought help from Dean Wooldridge and Simon Ramos. They were the founders of TRW and their biggest selling point was bringing the discipline of systems engineering to the USAF and the hundreds of contractors involved in the design, production, and deployment of thousands of ICBMs. (See Fiery Peace in a Cold War by Neil Sheehan, the best resource to study this critical part of our nation's history).

Here's another little piece of history that is not so well-known. From 1963 to 1992, the University of Southern California's Institute of Safety and Systems Management trained USAF officers in the discipline of "Systems Management", awarding a master of science in the subject. Think of it as applying systems engineering to the management of complex weapon systems. And the Air Force certainly had some complicated weapons showing up in our inventories in this time period, ICBMs being the most complicated.

Nearly from the beginning in the 1950's it was understood that certain aspects of this massive complex system had to be focused on sustainment, that is, sustaining the capability of the system to provide effective deterrence over the years after initial deployment. For instance, sufficient numbers of missiles were produced to allow for frequent flight tests. Solid motor fuel was tracked for cracking. Gyroscopes were not only refurbished, but also re-characterized as they transited the repair depot to help improve missile accuracy.

Performance and hardware tracking data systems were developed and improved. When liquid 4th stages were developed and produced for Minuteman III, extras were built for the sole purpose of age surveillance. Other similar approaches accelerated and were considered part of the cost of doing business throughout the 1960s and 1970s.

As time moved forward, ICBMs no longer enjoyed the #1 priority they had in the earlier years. For instance, subsequent US presidents were, understandably, not granting General Schriever's successors the same kind of top cover he received during initial designs and deployments. USAF budgets were beset by Viet Nam priorities and after Viet Nam, dealing with hollow force issues. On the vendor side, even industries that ICBMs helped create, such as Texas Instruments, were less responsive. Formerly, they actively looked for ways to help the Air Force, but subsequently created gigantic civilian markets. With much larger number of orders than the USAF could ever have, these customers got most of the vendors' attention.

In the 1980's, the workload for ICBM sustainers grew significantly as their ability to muster priority declined, their funding shrank, and new risks and failure modes emerged that were never prepared for by the original designers.

Another part of the trend was the march to transfer various ICBM programs from Air Force Systems Command development to Air Force Logistics Command sustainment. Not strictly true, but generally, USAF officers and civil servants new to ICBMs in California and Utah focused their efforts on sustainment and older, seasoned personnel still worked development programs. Many of these folks in both areas had the USC Systems Management degree. Contractors such as TRW, Boeing, Lockheed, and Northrop hired separated and retired USAF ICBM experts, many with the Systems Management degree. And even if cooperation between AFSC and AFLC sometimes waned, the individuals who worked ICBMs in both organizations knew each other and helped each other keep ICBMs a viable deterrent.

The nation now had a vast maze of the nation's thousands of different ICBMs deployed across the Northern Tier and maintained across the US. The Strategic Air Command continued their insistence on (impossibly?) high standards of availability, reliability, accuracy, hardness from attack, safety, and surety.

I was a separated USAF captain hired by TRW in 1985 with a BS in Astronautical Engineering, fresh experience in the USAF Space Program at Los Angeles AFS, and the USC degree in Systems Management. My impression of those times was that sustainers were feeling the pressure, and the lessons from the USC program in systems management rose up to help solve these problems.

(Continued on Page 26)

COVID living as a proxy for life in space *(Continued from Page 3)*

(27 Apr 2020 © 2020, Brent Sherwood) (with Author's permission)

All space living will be socially distanced. Groups of many sizes will live and work isolated from each other by vast distances that are expensive and time-consuming to bridge. All populations will be small compared to the total human population; it will take a long time to attain even the scale of a modest town, of order 100,000 people. Interaction between isolated groups will occur primarily through telecommunications.

Weird ways of getting together

COVID quickly shredded the fabric of modern social interaction: working in teams, socializing at will, and sharing experiences like eating, shopping, and attending entertainment or cultural events. Promenading and people-watching is no longer a casual pleasure. Retail shopping is less about browsing than about completing a mission. The quotidian interactions that define much of civilization are largely stripped away.

We are learning how to get business done with virtual meetings. Our conversations now depend on low-resolution, lagging, stuttering images and circuit-dependent vocal clarity, and are frustrated by dropped links. Speaking one at a time is now not just polite, but mandatory. Whiteboarding is stilted. Presentations lack direct audience feedback: there is no longer a "sense of the room". All-hands meetings are about broadcasting and curated dialogue, and lack immediate fellowship. And increased reliance on remote communication increases exposure to cyber intrusion. "Zoom bombing" is now a thing.

In workplaces, meeting room seating is self-consciously sparse, making such venues even less intimate for virtual attendees. Industrial and retail work is being recast beyond better sanitization to include physical barriers, two-meter separation, and face masks.

Covering faces in public is now expected behavior across religions and around the world.

Online video chat is what we do. People are experimenting with substitute entertainments like virtual happy hours and synchronized movie screenings. Dinner parties now optimize at four sites because tiling a screen into quadrants feels intimate. We reconnect with distant friends to feel reassured, as we see that at any time, people we care about might be felled.

Virtual get-togethers of all sorts prepare us to some degree for life in space. Crew onboard the International Space Station already use teleconferencing to stay in touch with ground crews, researchers, and families. In low Earth orbit, and maybe out to lunar distance, minor signal delays still allow near-real-time virtual meetings. However, among the near-Earth asteroids, or at Sun-Earth L4 and L5, a several-minute signal delay precludes immediate telepresence.

Travel-mediated pandemic

20th century air travel directly connected the world's cities, enabling our modern way of working, exchanging goods and services, recreating, and migrating. Since humans are the main carriers of human disease, air travel is now the most immediate global vector for respiratory pandemics; within just hours, one infected passenger can introduce or reintroduce a dangerous virus into a population.

This immediacy will complicate the reopening of population nodes that have been locked down to stall, contain, and hopefully eliminate COVID-19. Incubation latency is days, but transcontinental travel takes only hours, so episodic resurgences will be very hard to prevent. Without a new type of immunological monitoring – instant viral-load testing at TSA checkpoints? – restoring the lifestyle we knew before March 2020 is not assured.

As the USS Theodore Roosevelt anticipates, small populations in enclosed space habitats are extremely vulnerable to pathogens introduced from other populations. Earth orbital stations manage this today with pre-flight quarantine, for crew and space vacationers alike. Long trip times will protect far-flung settlements against accidental infection, but only extreme security protocols can defend against sabotage.

Protocol living

With COVID, we are learning how to conduct EVAs to do essential things away from home: we consolidate errands, suit up to leave our habitat, are vigilant about our surroundings and assiduously follow protocols while exposed, doff and decontaminate our garments upon returning home, and methodically clean supplies and consumables we introduce into our habitat.

(Continued on Page 26)

Connecting to space through dark night skies *(Continued from Page 4)*

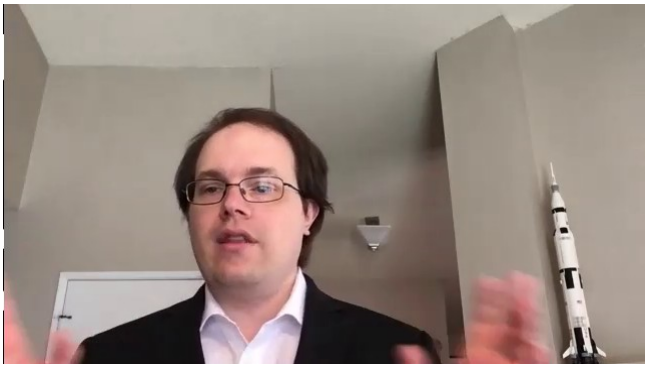
My role at IDA is to direct our public policy work, a field in which the organization has been involved nearly since its founding. We work with jurisdictions at levels from municipalities to national governments to write, enact and implement laws and regulations governing the use of outdoor lighting. These incorporate legal best practices gleaned from experience in a diversity of settings, which balance the needs of the nighttime environment, public safety, and private property owners. IDA offers decision makers both timely, scientifically validated policy analysis and model legislation that can be used to influence the development of robust public policies everywhere.

IDA's reputation and ultimate success rests on our conviction that the problem of light pollution is tractable, and that the solutions are technically feasible, aesthetically pleasing, safe and cost effective. There is no technical barrier to achieving the mission of darker night skies and healthier and safer outdoor spaces at night, and we need not shut all of the world's lights off to achieve our goals. It is now only a matter of convincing enough people to join us in our quest.

Bio: John is an Arizona native and comes to IDA from the "dark side" of science: professional astronomy. He obtained a master's degree in physics at Colorado State University and master's and doctoral degrees in astronomy at the University of Texas at Austin. From 2001-06 he was on the staff of Apache Point Observatory in New Mexico, serving as both an Observing Specialist on the Astrophysical Research Consortium 3.5-meter telescope and as an Observer for the Sloan Digital Sky Survey. John has contributed to science in fields ranging from solar physics to galaxy evolution while helping develop hardware for ground-based and aircraft-borne astronomy. Throughout his career, he has been involved in education and outreach efforts to help increase the public understanding of science. In addition to his work for IDA, John is a member of the steering committee of the University of Utah Consortium for Dark Sky Studies, a member of the American Astronomical Society Committee on Light Pollution, Radio Interference and Space Debris, a member of the International Astronomical Union, and a Fellow of the Royal Astronomical Society. He is the author of two books on the history of astronomy, The Lost Constellations and Uncharted Constellations. The asteroid (14505) Barentine is named in his honor. His other interests include history, art/architecture, politics, law and current events.

AIAA LA-LV New Space mini-Conference 2020 (18 April, 2020) *(Photos Only) (From Page 6)*

Mr. Jay Gallentine (Book Author) moderating the event after Dr. Sonwane left the meeting. (Screenshot)

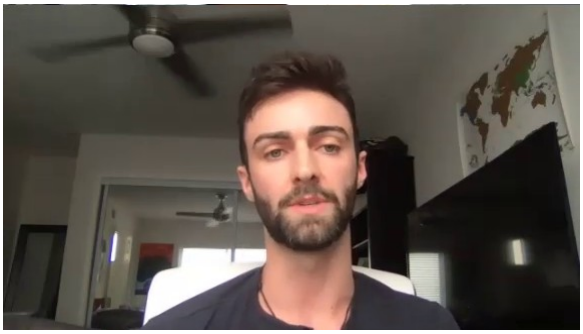


Mr. Matthew Kuhns (Masten) talked about the exciting Lunar Exploration Lander and Additive Manufacturing. (screenshot)

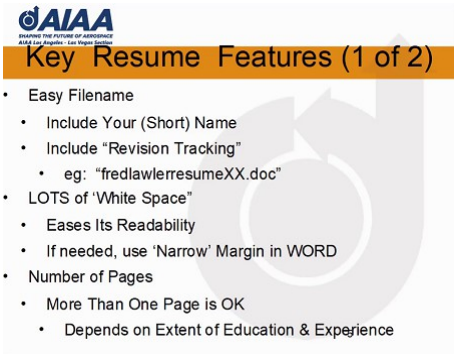
Ms. Beth Mund's professional moderation (after Mr. Gallentine left slightly after lunch time) and soothing voice elevated the event to the next level. (Screenshot)

Mr. Marty Waldman talking about the promising nuclear power micro-grids and aerospace development in Las Vegas. (Screenshot)

Prof. Joyce Liao (Stanford U.) talking about the Space Microgravity effects on astronauts' brains and the link to COVID-19. (Screenshot)



Mr. Brett Cornick gave a short talk on the Sustainable Technologies for Earth and beyond. (Screenshot)



Mr. Fred Lawler dialed in and presented the Resume Workshop.

Mr. Moises Seraphin (AIAA LA-LV YP Chair) shared his honest and fun view about the future of Space Colonization, from the young generations' point of view, and some insights on Sci-Fi. (Screenshot)

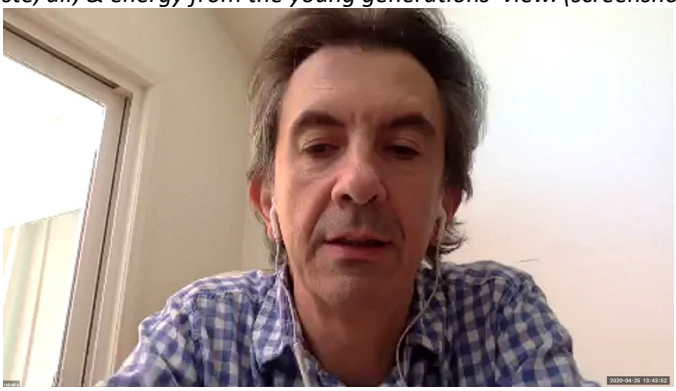
(Continued on Page 28)

AIAA Los Angeles Las Vegas and SCALACS joint Earth Day e-Town Hall Meeting (25 April)

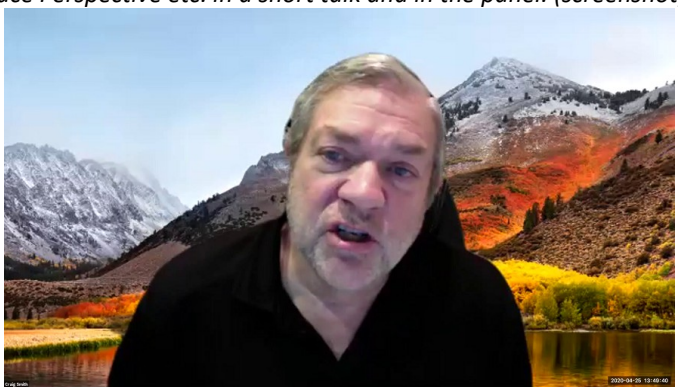
(Photos Only) *(Continued from Page 8)*

Mr. Brett Cornick on new Earth / Space sustainable technologies in waste, air, & energy from the young generations' view. (screenshot)

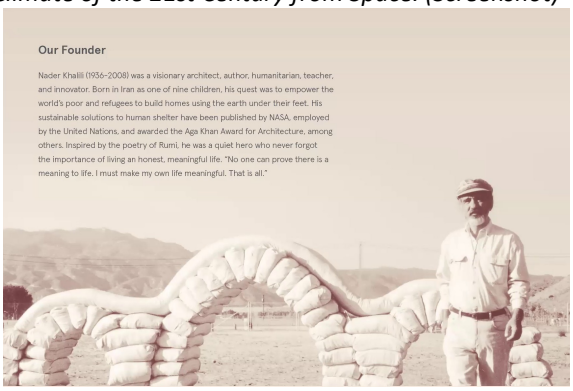
Jane Poynter and Taber MacCallum talking about the Bio-Sphere, Space Perspective etc. in a short talk and in the panel. (screenshot)



Dr. João Teixeira, Co-Director, Center for Climate Sciences, NASA JPL, on the Climate of the 21st Century from Space. (Screenshot)



Prof. Croig Smith talking about the new nuclear power technologies in the panel discussion & in the presentation with Marty Waldman.



Mr. Dastan Khalili gave a short talk and joined the panel discussion about Cal Earth Institute and what his father worked hard for.

Mr. Marty Waldman presenting the exciting new nuclear power grids technologies. (Screenshot)

Mr. Erik Jessen dialed in and talked about Leadership.

An attendee from the American Nuclear Society making a comment.

AIAA LA-LV e-Town Hall Meeting (2 May, 2020) with Michael Staab / Shawn Boike
Mars 2020: Perseverance Rover and the Search for Life on Mars / U.S. Space Force (USSF)

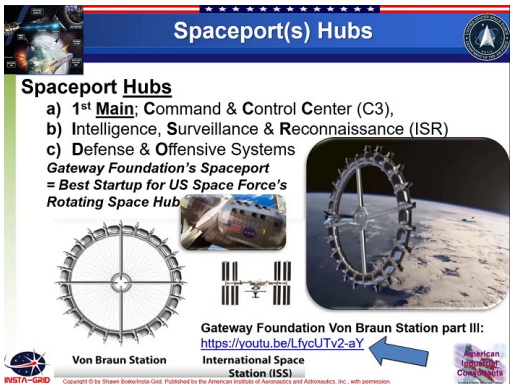
(Photos Only) *(Continued from Page 9)*

The first speaker, Michael Staab, will be back giving another talk on the Cassini Mission on June 6, 2020, and also a launch watching event in July for the Mars 2020. (Screenshot)

The second speaker, Shawn Boike, making a very smooth transition between Michael's talk and his US Space Force talk, and chatting with Michael a little bit during the transition. (Screenshot)

Outlines of Mr. Shawn Boike's presentation on U.S. Space Force. (Screenshot)

Steven Kwast (Ret. USAF. Gen.): The Urgent Need for a U.S. Space Force (youtu.be/KsPLmb6gAdw), a Must-See for U.S. Space Force, according to Shawn Boike during the talk. (Screenshot)



Spaceport(s) Hubs (like the von Braun Station proposed by the Gateway Foundation) could be an important part. (Screenshot)

The future of ISS is uncertain, but the possible Spaceport(s) Hubs can play important roles in the U.S. Space Force. (Screenshot)

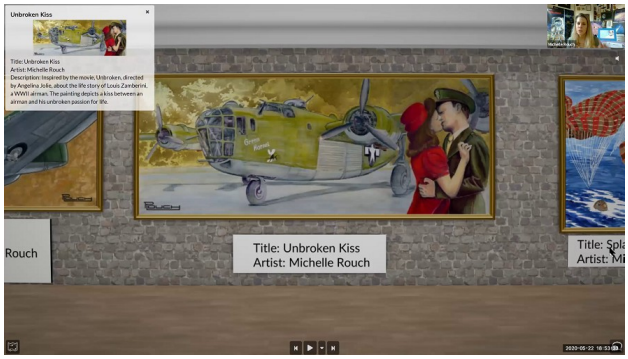
e-Gallery Reception / e-Happy Hour (22 May, 2020) Meet the Artists for the First-Ever AIAA LA-LV Virtual Gallery Aerospace Art Exhibition (May 9 – July 11): Michelle Rouch, Mark Pestana, and Aldo Spadoni *(Photos Only)*

(Continued from Page 13)

Aldo Spadoni showing his art/model from his studio. (Screenshot)

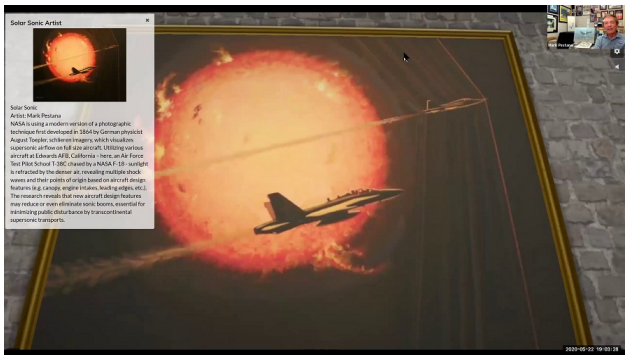
Aldo Spadoni explaining one of his master pieces in the e-Reception.

Michelle Rouch showing her art from her studio. (Screenshot)



Michelle Rouch explaining one of her master pieces in the event.

Col. Mark Pestana showing his art and NASA pilot helmet/mask.



Col. Mark Pestana explaining one of his master pieces in the event.

Marty Waldman joining the Happy Hour. (Screenshot)

Michelle Rouch saying Good Night! after the e-Reception!

Crew Dragon DM-2 and First Flights: A Historical Perspective (23 May, '20) with authors from the Outward Odyssey series of spaceflight history books: (Michelle Evans) Francis French, David Hitt (Moderator), Richard Jurek, Emeline Paat-Dahlstrom, Melvin Croft, Geoffrey Bowman, and Chris Petty

(Photos Only) *(continued from Page 14)* *https://www.nebraskapress.unl.edu/series/outward-odyssey-a-peoples-hist*

Emeline Paat-Dahlstrom (Joined from New Zealand)

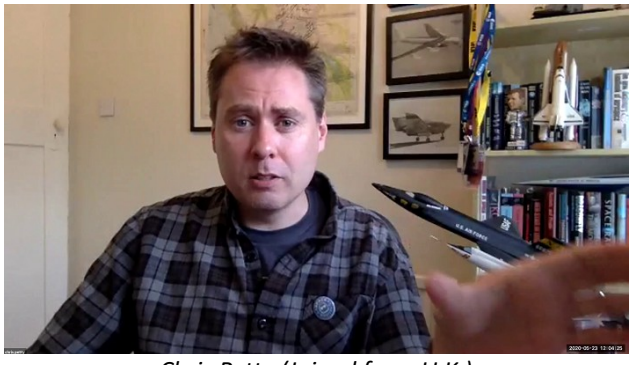
David Hitt (Moderator)

Richard Jurek

Geoffrey Bowman (Joined from U.K.)

Francis French

Melvin Croft

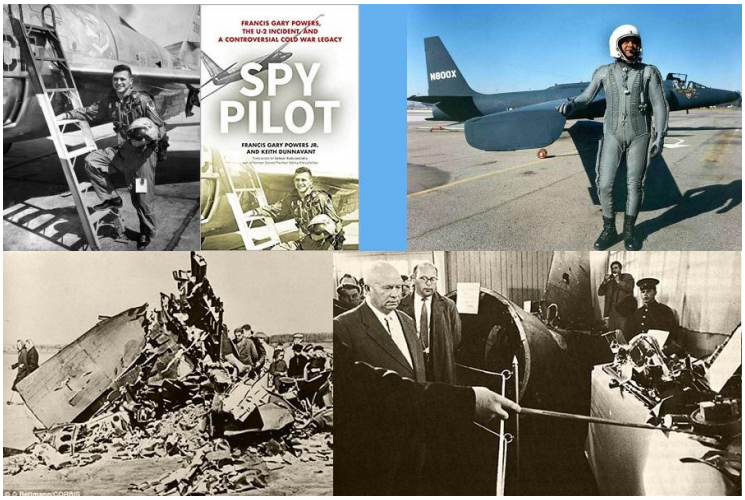


Chris Petty (Joined from U.K.)

Michelle Evans (though she could not make it this time, she will be joining next time if possible.)

March 05, 2020: Spy Pilot, Francis Gary Powers, the U-2 incident, and a Controversial Cold War Legacy *(Continued from Page 15)*

The story, as told by Powers Jr., started when his father was recruited into a so-called secret civilian program by the CIA to pilot the U-2 plane. It was on May 1st, 1960 that Powers' plane was hit by a SAM near Kosulino, Ural Region. Because of the U-2's extreme operating altitude at 75,000 ft, previous attempts by the Soviets to hit it with a surface-to-air missile had proved to be unsuccessful. Powers was able to parachute safely onto Russian soil, onto a farm, where he was met by a farmer speaking Russian. Then, a black car allegedly pulled up and he was captured by the KGB.



Book cover and related archive photos. (Photo Courtesy of Francis Gary Powers Jr.)

Powers Jr. went on to illustrate the details of his father's life under captivity. His father was stripped of his belongings, which included a modified silver dollar that contained a lethal poison-tipped needle. It was the choice of the pilot whether to use it or not. During his captivity, Powers was not tortured, because the Soviets wanted to show the world how humane the KGB were and he was too high profile a spy to torture.

Powers did as he was instructed by the CIA. He was to be friendly and give information about the mission to take photographs, but he was to withhold information about the specifications of the plane and the equipment on-board. The Soviets implemented various tactics including having Powers live with another prisoner whom Powers almost trusted, but this prisoner friend was likely attempting to gather information.

After the spy exchange in 1962, although Powers was cleared by the CIA of any guilt, public opinion was divided. Because the U.S. government did not want to admit that Soviet technology was more advanced than previously thought, it was assumed that the U-2 plane was shot down because the pilot had made a mistake. There was also misinformation regarding the poison needle and that Powers was instructed to use it if captured. Speculation was also circulating about how much information Powers revealed to the Soviets.

The Intelligence Star of Valor was awarded in 1965, after Powers was cleared twice by the CIA and the Senate. Many honors were posthumously awarded to Powers for his heroic actions in withholding information under captivity and for piloting the U-2. Powers Jr. reflected that his father's reputation has been fully vindicated, but it took a long time because of the Cold War and the length of time before information was declassified. It was revealed later, in 1998, that the CIA civilian program was in fact a joint military operation with the Air Force, but this could not be revealed during the Cold War to avoid provocation leading to a world war. The Air Force finally corrected the records and awarded Mr. Powers posthumously the POW Medal and the Distinguished Flying Cross. The CIA awarded him the Director's Medal for extreme fidelity and courage in the line of duty. Tonight's presentation showed that it is never too late to set the record straight, but also highlighted the difficult situation many faced in the Cold War era.

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. During the quarantine, he continues to support our military and takes the extra time to bond with friends and family. He enjoys playing the violin and competitive table tennis (now on the Wii). His dream is to send at least a screw into space, 10-32 100 deg flathead preferable.

ICBM Sustainers Kept the Weapon System Effective for Decades *(Continued from Page 17)*

Stepping back even earlier to the dawn of the Industrial Revolution (think Evans Flour Mill, 1795) and the dawn of Industrial warfare (US Civil War, 1865), the dawn of aerospace itself (controlled powered flight, 1903), the birth of systems engineering (Bell Labs, late 1930's), a trend becomes obvious. More and more complex systems are being mass produced and each system is living longer as each year passes. Conclusion: If you are not yet part of a team sustaining a complex system, you will be.

With the end of the Cold War, fewer USAF officers on alert taking correspondence courses, and fewer aerospace companies in the Los Angeles area attending on campus, the business model for the USC Systems Management degree led to its end in 1992, and eventually the Institute itself ended in 1997. Some professors within the Institute transferred to the Viterbi School of Engineering, the alumni of this program became part of the Viterbi School of Engineering alumni group. USAF officers are still expected to get masters degrees early in their careers, but the Master of Science in Systems Management is no longer among the options.

This is the first in a series of newsletter articles that describes the solution that the ICBM sustainers came up with, how they fit that solution into one integrated sustainment management system, and what these solutions mean for all of us today as we struggle with the very same problems that the 1980's ICBM sustainers struggled with.

Over the next few newsletters, we will see how observing the precisely-defined system can lead to well-crafted risk priority lists and risk mitigation programs, integrated for efficient deployment. We will see how a few do-able culture changes create teammates ready to identify emerging issues. And we will see how processes and data systems are kept up to date to support these approaches.

Next newsletter, we will start with defining our terms, especially readiness factors such as availability, reliability, accuracy, hardness from attack, safety, and surety.

About the Author:

Please see the AIAA Member Spotlight on Page 28 for the author's biography. The author will give his popular talk in AIAA LA-LV e-Town Hall Meeting on Saturday, August 8, 2020, *"In-flight Refueling the SR-71 During the Cold War"*(conta.cc/2WdBwYF).

COVID living as a proxy for life in space *(Continued from Page 18)*

(27 Apr 2020 © 2020, Brent Sherwood) (with Author's permission)

Governing controls and public adherence both vary across cultures. Societies more accustomed to authoritarian bureaucracy and social harmony, like China, have demonstrated agility in quickly making and upholding fundamental changes to curtail transmission. Accustomed to individual freedoms, the USA has a patchwork of rules, and popular protests against restrictions already after just weeks.

Spacefarers already know that their survival and productivity depend on thorough protocols and procedural checklists. The cadence of space living revolves around rules. Deviating from procedure requires thoughtful vetting, planning, and responsive monitoring; individual impulse can quickly threaten all.

Buffer size

Our COVID world is drastically reduced. We manage our home inventories of food and supplies, working around local shortages and limiting resupply expeditions. Increasingly, we hire logistical services like home delivery and reinvented services like "zero-touch plumbers". This makes us more aware of our dependence on the infrastructure of civilization. Cities and industrial supply chains, and our immense atmosphere, oceans, and lands have buffered us against disruptions small and large. Historically, services are restored in storm and wildfire-ravaged areas, and even flooded cities get rebuilt. But simultaneous disruption everywhere brings our capacity margin into sharp focus. Buffers – extra capacity – of critical supplies and key services are being revealed to be thinner than most people ever thought about, and this alerts us to the fragility of our way of life.

(Continued on Page 27)

COVID living as a proxy for life in space *(Continued from Page 26)*

(27 Apr 2020 © 2020, Brent Sherwood) (with Author's permission)

Space habitats are extremely sensitive to buffer size. Spare atmosphere is contained in high-pressure gas bottles; potable water is made from cabin condensate and reprocessed waste; food comes from freezers and storage lockers. Tomorrow's space habitats will cultivate food and use aquatic systems to purify water and generate oxygen. But space settlements will always have thin buffers; even at urban scale, with forests and wetlands, buffer health will be stewarded as a life-critical resource.

Reconnecting with our nature

In space, Maslow's hierarchy is very real. Space architects and human space flight engineers consider what kills us quickest: without atmosphere, death occurs in seconds; without temperature control, maybe hours; without potable water, days; without food, weeks. Beyond that, debilitating factors – space radiation, microgravity, lack of access to medical care – vie for lethality dominance depending on circumstances. The top of the Maslow pyramid is space architecture: beyond the many survival requirements are needs and expectations that govern work effectiveness, psychological well-being, sociological accommodation, and enrichment of the human spirit.

We find COVID living to be uncomfortable and disorienting, and we dearly hope to make it temporary. Civilization will tentatively climb back toward normalcy, but likely settle into new equilibrium behaviors, as we did after September 11, 2001, that cannot be fully predicted yet. Only biomedical science can restore a semblance of what we so recently knew.

Meanwhile, this disruption and adjustment can teach us insights about living in space one day. We have become – at least for a time – keenly aware of what we breathe and touch, who is nearby and how everyone behaves, and what we allow into our habitat. We are paying closer attention to what keeps us alive as individuals and functioning as a society than ever. We are reminded that, despite our aspirations and constructions, we are animals immersed in and sustained by a complex ecosystem. The existential threat of a readily communicable, sometimes fatal virus abruptly reconnects us with nature, more vividly than our rampant ecosystem damage has been able to do. One way or another, this connection is a reality we must inhabit every moment, if we are to thrive out in space.

About the Author:

Brent Sherwood is a space architect with 32 years of professional experience in the space industry.

He is Vice President, Advanced Development Programs at Blue Origin, where he is accountable for ideation, development, and fielding of in-space products and services to enable a vision of millions of people living and working in space to benefit Earth.

Prior to Blue Origin, Brent was at the Jet Propulsion Laboratory for 14 years. As Program Manager for planetary mission formulation, he led JPL planetary mission strategy. His teams conceived, engineered, and proposed dozens of science mission concepts for exploring the solar system.

Prior to JPL, Brent was at Boeing for 17 years, where he led concept engineering for human planetary exploration, manufacturing engineering for ISS module integration, and program development for many commercial and space science projects including Sea Launch and ISS commercial modules.

He holds a B.A. in liberal arts from Yale, a Master of Architecture from the Yale School of Architecture, and an M.S. in aerospace engineering from the University of Maryland.

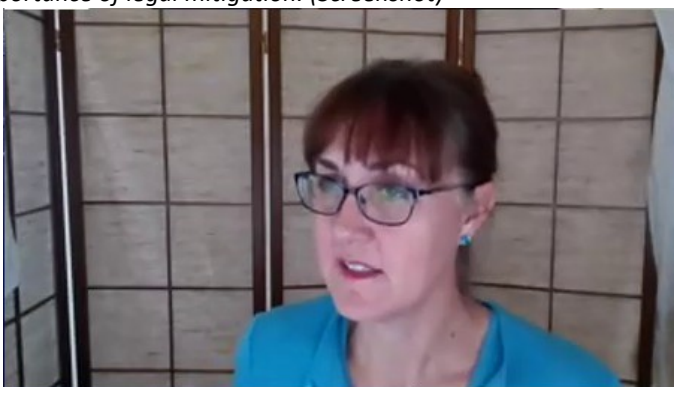
Brent has published and presented over 50 papers on the exploration, development, and settlement of space; and edited the AIAA book Out of This World: The New Field of Space Architecture.

He is a senior member of AIAA (American Institute of Aeronautics and Astronautics), was chair of the AIAA Space Architecture Technical Committee from 2018-2020, and served on the Board of the American Astronautical Society from 2017-2019. In 2020 he received the Columbia Medal from the American Society of Civil Engineers.

AIAA LA-LV New Space mini-Conference 2020 (18 April, 2020) *(Photos Only)* *(Continued from p. 20)*

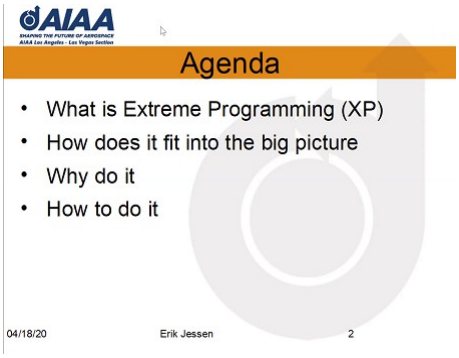
Mr. Jared Schneider explaining the problem of space debris and the importance of legal mitigation. (Screenshot)

Mr. Larry Trager discussing the the advanced space power options provided by Aerojet-Rocketdyne. (Screenshot)

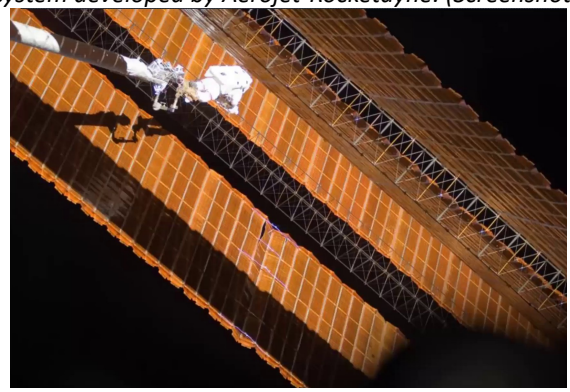


Ms Jennifer S. Perdigao (Attorney, Pilot) talking about the resources and details about legal liability mitigation framework for space debris. (Screenshot)

Dr. Cheng-Yi Lu dialed in and talked about the various advanced power system developed by Aerojet-Rocketdyne. (Screenshot)



Mr. Erik Jessen (Raytheon) on Extreme Programming (XP). (dial-in)



Dr. Cheng-Yi Lu talking about the ISS solar power panel makeshift repair performed by astronaut Scott Parazynski (2007). (Screenshot)

Mr. Frank Czopek on the interesting Pre-History of GPS.

Dr. Seth Potter talking about the orbit options for near-term space solar power. (Screenshot)

AIAA Member Spotlight Summary (24 April, 2020 – 29 May, 2020) *(4 May, 2020)*

James R. French

AIAA Fellow
(60+ year member of AIAA !)

President, JRF Aerospace Consulting LLC

James R French graduated from MIT in 1958 with a degree of BSME Specializing in Propulsion. While at MIT, Mr French became the Founding President of the MIT Chapter of The American Rocket Society, an AIAA predecessor. In the ensuing years he has pursued additional education both in technical subjects and management.

Upon graduation, he accepted a job with Rocketdyne Div. of North American Aviation and during a 5 year employment, worked on developmental testing of H-1 engines and combustion devices hardware for F-1 and J-2 engines used in Saturn 5. He was also involved in various experimental programs. Moving on to TRW Systems, Mr. French was Lead Development Test Engineer on the Lunar Module Descent Engine and was responsible for bringing on-line the High Altitude Test Stand use for all-up LMDE testing at TRW's Capistrano Test Site. He also was involved in experimental testing of exotic propellants.

After leaving TRW as propulsion work ran down, Mr. French joined the Jet Propulsion Laboratory where he worked on testing and launch vehicle integration for Mariners 5, 6, 7, 8, and 9; Viking 1 & 2 and Voyager 1 & 2. Mr. French was Advanced Planetary studies Manager for JPL for several years as well as Chief Engineer for the SP-100 Space Nuclear Power System. He was Chief Engineer of a RTG powered Mars Rover study for a vehicle essentially identical to Curiosity.
Leaving JPL after 19 years, Mr. French was VP Engineering and Chief Engineer for American Rocket Company developing hybrid rocket launch vehicles.

Since leaving AMROC in 1987, Mr. French has been consultant to a variety of aerospace companies, SDIO, NASA, and USAF. As a consultant to SDIO he functioned as the government's chief engineer on the DC-X project. He has participated in various startup companies in the private space flight arena and currently consults extensively to Blue Origin, a company in which he has been involved since its beginnings. He has worked with Project Icarus investigating interstellar missions. His current efforts draw primarily upon his extensive experience in rocket propulsion development and operational aspects of launch vehicles.

Mr. French is co-author with Dr. Michael Griffin of the best-selling text Space Vehicle Design, published by AIAA. For over 20 years he taught a 4 day short course, mostly through AIAA, on the same topic. The second edition of the book has received the Summerfield Book Award for 2008. Mr French is also the author of Firing a Rocket, a reminiscence of testing rocket engines for the Apollo missions.

Mr. French is a Fellow of both AIAA and the British Interplanetary Society and a 60+ year member of AIAA. He has held several Technical Committee and other posts in AIAA. In 2018, Mr. French was named Engineer of the Year by the Orange County Section of AIAA.

Here is the inspiration for his going into the aerospace career: (Excerpt from Firing a Rocket written by James French, published by Amazon. Used with permission of the author,)

Long before I ever went to college, I knew that there was only one career for me. I wanted to work on rockets and go into space. That began when, at about 12 years old, I read Robert Heinlein's Rocketship Galileo. Before that I had read "Flash Gordon", "Buck Rogers" and other comics but never took it seriously. Once I read that book, a whole new universe opened to me and I knew what I wanted to do. I devoured every science fiction writing I could find with particular emphasis on the "hard" science fiction of Heinlein and Arthur Clarke. I also got into the non-fiction side with Willy Ley's Rockets and its two sequels Rockets and Missiles and Rockets, Missiles, and Space Travel. Then came Ley and Bonestell's The Conquest of Space and Clarke's The Exploration of Space and Interplanetary Flight. I was hooked for life and I have never once regretted the choice.

Since no one in my family had any college education or any real interest outside home and farm, I was all alone. They all thought I was crazy and referred to me as "Einstein" or "The Absent-Minded Professor". (Absent-mindedness was definitely valid and has only gotten worse with age.) I really had no idea how to follow my dream except that I knew I needed to go to college. I had no idea where to go but fortunately I could find help. Our neighbor, family doctor, and good friend, Dr. Walter Watkins, had been born and raised in Amarillo just as I was. However, he had joined the Army and ended up getting his MD from Johns Hopkins. He moved back home and rapidly became the top surgeon in the area. He understood where I was coming from and provided me with much sound advice and encouragement. Two of my High School teachers, Miss Wilson for mathematics and my physics teacher whose name now escapes me also helped. This latter lady and I were often at odds but she helped me whenever she could in spite of that. I owe them all a huge debt for helping an eager but ignorant kid.

AIAA Member Spotlight Summary (24 April, 2020 – 29 May, 2020) *(11 May, 2020)*

Mr. Steve Isakowitz

AIAA Fellow
President and CEO, The Aerospace Corporation

Steve Isakowitz is President and CEO of The Aerospace Corporation, where he leads a team of about 4,000 employees committed to solving the hardest problems in space. Aerospace is a national nonprofit corporation that operates a federally funded research and development center addressing complex problems across the space enterprise focused on agility, innovation, and objective technical leadership.

Over the course of his more than 30-year career, Isakowitz has served in prominent roles across the government, private, space, and technology sectors, including at NASA, U.S. Department of Energy, and the White House Office of Management and Budget. Prior to joining Aerospace, he was President of Virgin Galactic, where his responsibilities included the development of privately funded launch systems, advanced technologies, and other new space applications.

His work has been widely recognized and awarded, including the NASA Outstanding Leadership Medal and the Presidential Distinguished Rank Award. He also co-authored the AIAA's International Reference Guide to Space Launch Systems, which received the Summerfield Book Award in 2003.

Isakowitz's passion for space was formed at an early age as he watched the Apollo 11 astronauts walk on the moon. The film 2001: A Space Odyssey further inspired a vision of space that was accessible to all, where anyone would have the chance to travel through space.

While his dreams of starting a space company after graduating from the Massachusetts Institute of Technology were stifled by the high-cost launch environment of the 1980s, he later found his way back to space entrepreneurship through his various roles at the leading edge of innovation and technology.

At Aerospace, Isakowitz is helping shape the future during what he describes as "the most exciting time in space… ever." He sits at the nexus of defense, civil and commercial space enterprises, overseeing efforts to outpace threats to the country's national security while nurturing the technologies needed to further a new era of space commercialization and exploration.

AIAA Member Spotlight Summary (24 April, 2020 – 29 May, 2020) *(18 May, 2020)*

Col. Charles Thomas Vono

AIAA Associate Fellow

Retired, Northrop Grumman (legacy TRW) and USAF

Born in 1952, Charles Thomas Vono grew up in Wasco, a small farming town just north of Bakersfield, California. His father, Mike, had been a ball turret gunner in B-24s, flying up the Adriatic to deliver death to Nazi industry. Charlie was named after his uncle who was a gunner as well, fighting in every major naval battle of the Pacific and then on to exploring Antarctica post WWII. The battles started with assignment to the New Orleans, dry-docked in Pearl Harbor and fighting back with their guns. (See the famous WWII song, "Praise the Lord and Pass the Ammunition"). As a kid, Charlie got various jobs around Wasco where he was known as the nephew of the man who ran Vono Jewelers. (Uncle Chuck took over after Charlie's father passed away in 1956.) Around 15, he got various jobs at farms outside of town, and then his last civilian job was selling door to door in Bakersfield. Like Dwight Yokum he has "Walked the Streets of Bakersfield".

Althought he wasn't exactly Merle Haggard's "Radiator Man from Wasco", Charlie's maternal grandfather was the top mechanic at the Dodge Garage in Wasco. Charlie's paternal grandparents were from Curcoli, Calabria, Italy. He had the good fortune to visit his ancestral village last July where they still remember Tommasso Vono as a "mean SOB" or words to that effect in Italian. Concetta died of the Spanish Flu in Des Moines, and Tommasso died in the Des Moines prison, leaving orphaned two sons (Mike and Chuck) and 3 daughters.

Moving along to 1969, it was "cutting over rows" with a shovel in 110-degree heat, at a farm west of Wasco Charlie remembers most clearly looking up and seeing a jet flying overhead from Edwards AFB. "I bet," he thought "those guys have air conditioning in those cockpits". This is somewhat akin to the answer Buck Owens gave when asked, "Why'd you get into Country Music?" "I sure as hell didn't want to pick cotton the rest of my life!" Why join the AF? The air conditioning!

Charles graduated from the USAF Academy in 1976 with a bachelor of science degree in Astronautical Engineering with significant coursework in control theory and computer science. Charlie says he owes a lot of his academic ability to the good Sisters of Saint Francis who taught him at St. John's Elementary School and his realization he could take on any profession to the local priest who told him he could. While at the USAF Academy, Charlie met his future wife, Juanita Williamson. They are celebrating their 44th wedding anniversary 4 June 2020. They have 3 married children and 3 grandchildren… so far. Nita is a real estate agent, Utah state fair blue-ribbon quilter (she's sewing lots of face masks right now), and rescues turtles. Charlie's place in southeast Ogden is a turtle sanctuary with hills, creek, and a pond.

Charlie's first assignment in the USAF was at Beale AFB in Strategic Air Command as a KC-135 air refueling pilot supporting the worldwide reconnaissance mission of the SR-71. Charlie also has a Master of Science in Systems Management from USC. He got this during his second USAF assignment in 1982 as Inertial Upper Stage Software Systems Chief at Space Division (now Space and Missile Center) in Los Angeles back in the days of Systems Command. This degree stood him in good stead during his 25-year career with TRW and Northrop Grumman sustaining our nation's ICBM force in Utah (1985 to 2014 with a 4 year pause in the middle). Many of his fellow sustainers possessed the same degree and applied the principles of systems engineering to management of this complex system. Charlie also has a Master of Science in Mechanical Engineering from Utah State University, again with significant coursework in control theory. Charlie was thrilled to have his primary professor be a man who had been on the control systems design team for the Saturn V.

While he separated from the USAF at the end of his Los Angeles career, he stayed active in the USAF reserves filling various positions at Hill AFB in Utah. He was a structural engineer in F-16s, a quality control engineer (writing Hill's first Quality Plan for competition), and manpower. Upon promotion to colonel, Charlie applied and won a full-time position on the commander's staff at Pacific Command, a joint command responsible for 2/3rds of the Earth. Charlie was the Reserve Forces Division Chief at a time when the US was generating its first ever partial mobilization of all reserve forces after the 911 attacks.

After this assignment, in 2003, Charlie returned to his position at TRW sustaining ICBMs, except TRW had been bought by Northrop Grumman. Charlie took on various challenges at that time, including acting chief of ICBM Propulsion and Northrop Grumman manager for ICBM Guidance Systems, before retiring in 2014.

Before retiring, one of Charlie's duties was teaching Minuteman III ICBM general familiarization to contractors and USAF personnel. In retirement, Charlie remains active in AIAA, INCOSE, and SAME and is an AIAA distinguished lecturer. He travels the country (pre-virus) giving presentations on "Refueling the SR-71 during the Cold War", "How to Keep Complex Systems Effective for Decades", "How ICBMs Work and Why They are Important", and "Evans' Flour Mill, the First Modern Factory". Charlie loves to show how today's world sprang from Industrial Revolution and WWII innovations. He gave a half-day class on keeping complex systems effective for decades at the 2018 INCOSE Western States Regional Conference.

Just before the virus, on 3 March, he was the keynote speaker for the 45th Dayton-Cincinnati Aerospace Sciences Symposium, where he became the first ever aerospace speaker to start his keynote leading the auditorium crowd in several verses of "Praise the Lord and Pass the Ammunition!".

Charlie is past chair of the Utah Engineers Council, a council of 17 engineering societies in the State of Utah that celebrate engineers week each year by declaring Utah engineer of the year and giving away 15 to 20 scholarships to undergraduate students in engineering. Charlie started the annual tradition of supporting a STEM booth at the Salt Lake City FanX comics convention, the 3rd largest in the US. Teaming with Hill AFB on this endeavor ensures amazing displays such as an F-16 cockpit for the kids and their parents to try out.

Charlie has posted his AIAA technical papers, posts, and presentations at his web site: charlesvono.com. He has ebooks on sustainment available at Amazon.com. You can find him on facebook (Charles Thomas Vono) and LinkedIn (Charles Vono).

Charlie will give an exciting and popular lecture/webinar with AIAA LA-LV "In-flight Refueling the SR-71 During the Cold War" on August 8, 2020. Please join us and enjoy! (conta.cc/2WdBwYF)

Saturday, May 30th, 2020, 1 PM – 4 PM (Pacific Time)

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

(Add to Calendar)

Spacecraft in Science Fiction

with

The Three Spacecateers

(Rod Pyle, Aldo Spadoni, & Rick Sternbach)

RSVP and Information: conta.cc/366jc77

Please click the link below to join the webinar:

https://aiaa.zoom.us/j/213164674?pwd=dEZvUUFic2Q3ZzNRVlZqditGdkpwQT09

Password: 977956

Or iPhone one-tap :

US: +16699009128,,213164674# or +12532158782,,213164674#

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Webinar ID: 213 164 674

International numbers available: https://aiaa.zoom.us/u/abctskKwFb

[events.aiaalalv@gmail.com] [http://aiaa-lalv.org/]

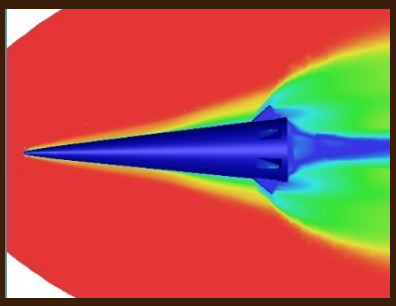
Saturday, June 6th, 2020, 10 AM – 12:30 PM (Pacific Time)

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

(Add to Calendar)

with Guest Speakers Swati Saxena and Michael Staab

Introduction to ANSYS -
Innovation Through Simulation
by
Dr. Swati Saxena
Technical and Project Manager - ANSYS Inc.



Cassini Mission
by
Michael Staab
Fault Management and Autonomous Systems Principal Engineer at Northrop Grumman Corporation

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(1-Click Link for joining the Zoom event online) (RSVP and Information: conta.cc/3bPYA4X)

Please click the link below to join the webinar:
https://aiaa.zoom.us/j/427331847?pwd=WUpxWVFFSHI5OGFMKzdFL2Ixei8xQT09
Password: 902185

Or iPhone one-tap :
US: +16699009128,,427331847# or +13462487799,,427331847#
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Dial(for higher quality, dial a number based on your current location):
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Webinar ID: 427 331 847
International numbers available: **https://aiaa.zoom.us/u/acbNmGHYv8**
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e-Town Hall Meeting by AIAA LA LV & SCALACS

June 13,2020, 10 AM (**Add to Calendar**)

STEM Women in Science and Engineering

40 Years of Overcoming Challenges

by

Dr. Claire Leon, Loyola Marymount University

and

An insight on Graphene Based Multiscale Coatings for Phase Change Heat Transfer Applications

by

Dr. Anju R. Gupta, University of Toledo

10:05 AM Dr. Chandrashekhar Sonwane (Welcome Message)
10:10 AM Dr. Brian Brady (Welcome Message)
10:15 AM Mr. Casey Moninghoff (AIAA LA LV Section STEM K-12 Activities)
10:20 AM Dr. Claire Leon (40 Years of Overcoming Challenges)
11:20 AM Dr. Anju Gupta (An insight on Graphene Based Multiscale Coatings for Phase Change Heat Transfer Applications)
12:30 PM Adjourn

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e-Town Hall Meeting

June 20, 2020, 1 PM - 3:30 PM

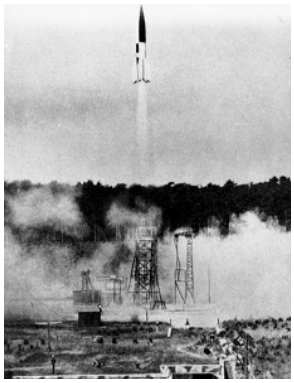
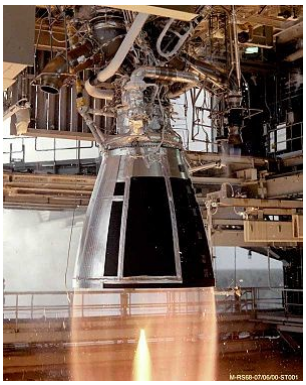
(Add to Calendar)

A HISTORY OF ROCKETRY

by

John Halchak, Senior Fellow

Engineering department of Rocketdyne (now named Aerojet Rocketdyne)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A HISTORY OF ROCKETRY

"Those who do not remember the past are condemned to repeat it" is the famous quotation of the philosopher George Santayana. For the engineer, knowing the mistakes of the past, including why they occurred, is a necessity to avoid repeating them. However, it also is important to know and understand past successes so that they may be stepping stones for future advances. Studying history also gives us a perspective of the present, helping us to understand why things are the way they are today and can point towards a path for change.

This talk will be a broad overview of the history of rocketry, with some emphasis on the importance of materials in the development of the technology. The American rocket pioneer, Dr. Robert H. Goddard, used some surprisingly advanced materials concepts for his rockets, combining metals and ceramics to achieve performance goals. Unfortunately, Goddard's paranoia combined with his inability to work with others, destroyed his legacy. In their V-2 ballistic missile of World War II, the Germans used a variety of materials, with wartime shortages necessitating some creative materials selections. The V-2, although ineffective as a weapon, had profound long-term consequences, as it jump started ballistic missiles and space exploration. The first American and Soviet rockets were essentially improvements on the German designs that also incorporated higher strength materials to reduce overall weight and increase performance.

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Asteroid Day
Planetary Defense and Asteroid Exploration (PDAE) mini-conference
Saturday, June 27, 2020, 10 AM



Dr. Nahum Melamed (The Aerospace Corporation)

(More TBD)

Jun 27, 2020 10:00 AM Pacific Time (US and Canada)
AIAA LA LV PDAE mini-Conference 6/27

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e-Town Hall Meeting

July 11, 2020, 10 AM (Add to Calendar)

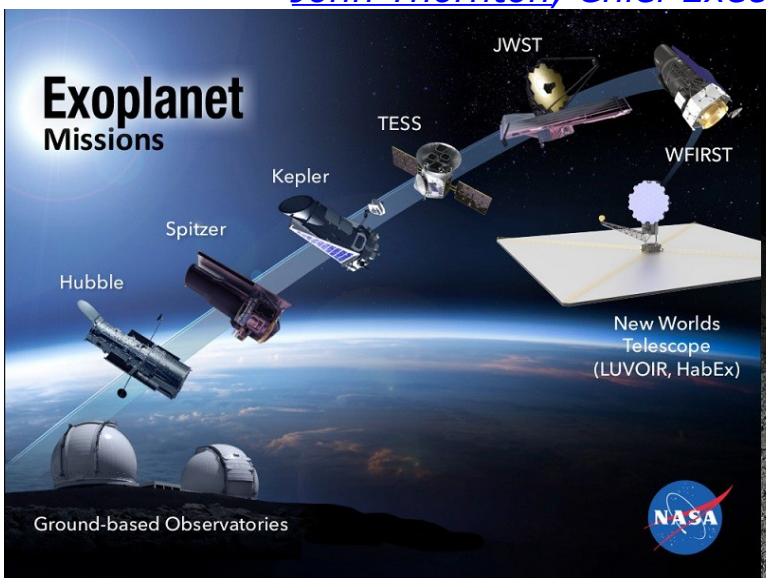
Towards Earth 2.0: Exoplanets and Future Space Telescopes

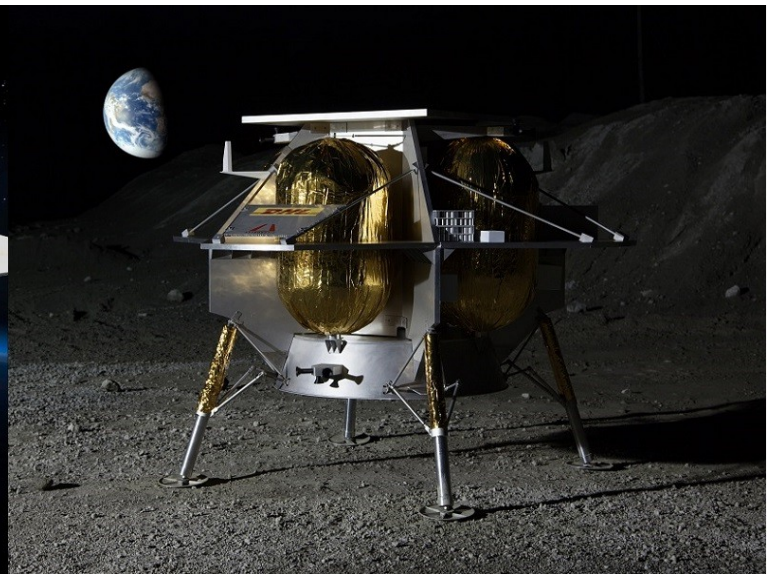
Dr. Aki Roberge, Research Astrophysicist
Exoplanets and Stellar Astrophysics Lab at NASA's Goddard Space Flight Center
(currently on temporary detail to NASA HQ)

&

Making Space Accessible to the World

John Thornton, Chief Executive Officer of Astrobotic





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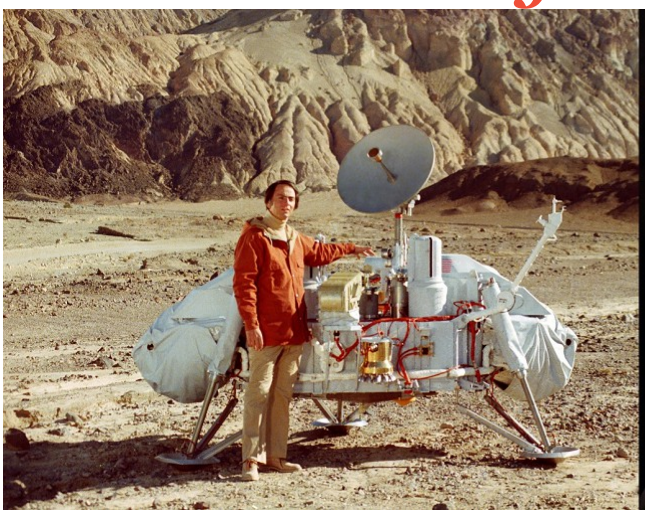
(Online) July 18, 2020, 10 AM (Add to Calendar)

Apollo 11 (51st) and Vikings (44th) Anniversary 2020 (Neil's Day)



James R. French, JRF Consulting, AIAA Fellow

"Gone But Not Forgotten, The Test Stands for the Rocket Engines of Apollo"

Before they lofted the Saturn launch vehicles into space and landed the Lunar Module on the Moon, the rocket engines in these vehicles had to be tested on the ground. This was first done on test stands at Santa Susanna, Inglewood, and San Juan Capistrano California before moving on to Edwards Rocket Base and NASA facilities. These original stands are mostly gone now but they appear again in the pictures of this presentation. Jim French worked on these engines and test stands and shares his memories of those days.

Prof. David Barnhart, Director, USC ISI / SERC, Faculty Liason to RPL/LPL

"Moving Past Apollo:
This generation's tools to build the 2nd major step for Mankind in Space"

(More Participants TBD)

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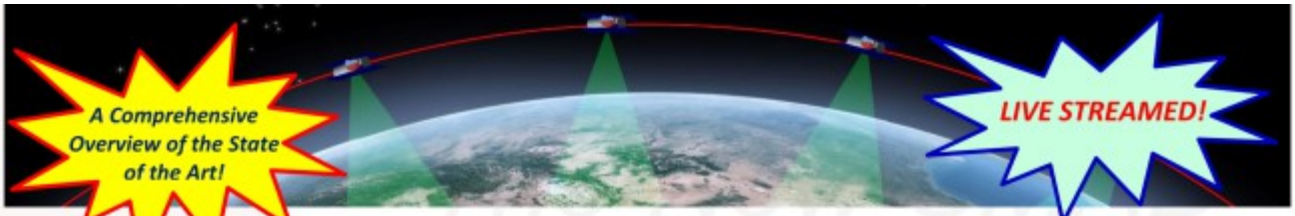

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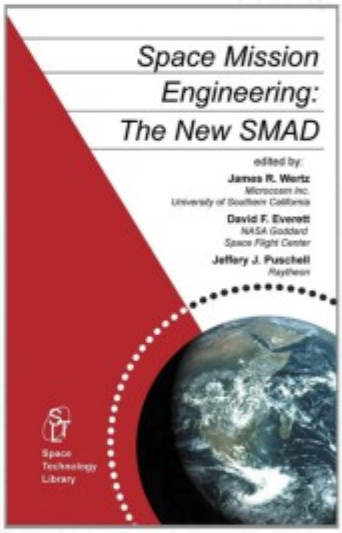

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Memorial Day Special: Honoring the Heroes

Digital Mosaic by Veronica Brooks, AIAA LA-LV Council Member

Hyperfast Flying Wing Package Drones and Air Taxis with Hydrogen (H_2) Fuel Cells, PLASMA Flow Control and Bionic StingRAY Geometry - **H_2PLASMARAY**

Berkant Göksel

Fig 1: *Left half shows the air taxi H_2PlasmaRay 6.66 and the right half a 1:6 scale model.*

Electrofluidsystems has recently revealed their vision for futuristic hyperfast flying wing package drones and air taxis with hydrogen (H_2) fuel cells, plasma flow control and bionic Stingray geometry (see Fig. 1). The advanced concept has great potential for a series of new UAV systems (UAS), with the first product on target to enter the market at the end of 2021. Therefore, it was also planned to reveal the first eVTOL prototypes with a 1.11 m wingspan at the UAS Innovation Hub at the Berlin Air Show ILA 2020 (see Fig. 2). However, the event was cancelled because of the threat of COVID-19, and the project was delayed by three months.

Fig. 2: *Exhibition booth design with 9 - 20 sqm.*

The near-term vision for 2021 - 2022 is to have mini UAS products with a 1.11 - 1.66 m span: 1. **PlasmaFalcon 1.11** with 6 - 11 kg maximum take-off weight (MTOW) and 2. **PlasmaRay 1.11** with 11 - 18 kg MTOW (see Fig. 3) in 2021. There are two types: **H_2PlasmaRay** uses a hydrogen (H_2) fuel cell module to demonstrate the technology as a proof of concept, whereby **PlasmaRay** uses Lithium-Polymer (LiPo) batteries only. For the **H_2PlasmaRay 1.11,** with a 300 - 379 bar internal tank (1 kg), the 0.8-liter volume and 16.5 grams of gaseous hydrogen mass is quite small. The overall specific energy is 110 Wh/kg,and thus is lower than that of LiPos with 150 - 200 Wh/kg.

Nevertheless, the fuel cell technology gets more interesting with the bigger 1.66 - 2.22 m scale models (1:4 - 1:3). The specific energy with gaseous hydrogen storage goes beyond values of 300 Wh/kg. Furthermore, there are amazing developments from MetaVista in South Korea and the USA regarding how to use liquid hydrogen for future drone applications. In 2019, MetaVista broke the multirotor UAV Flight Time World Record by demonstrating a flight duration of 12 hours,

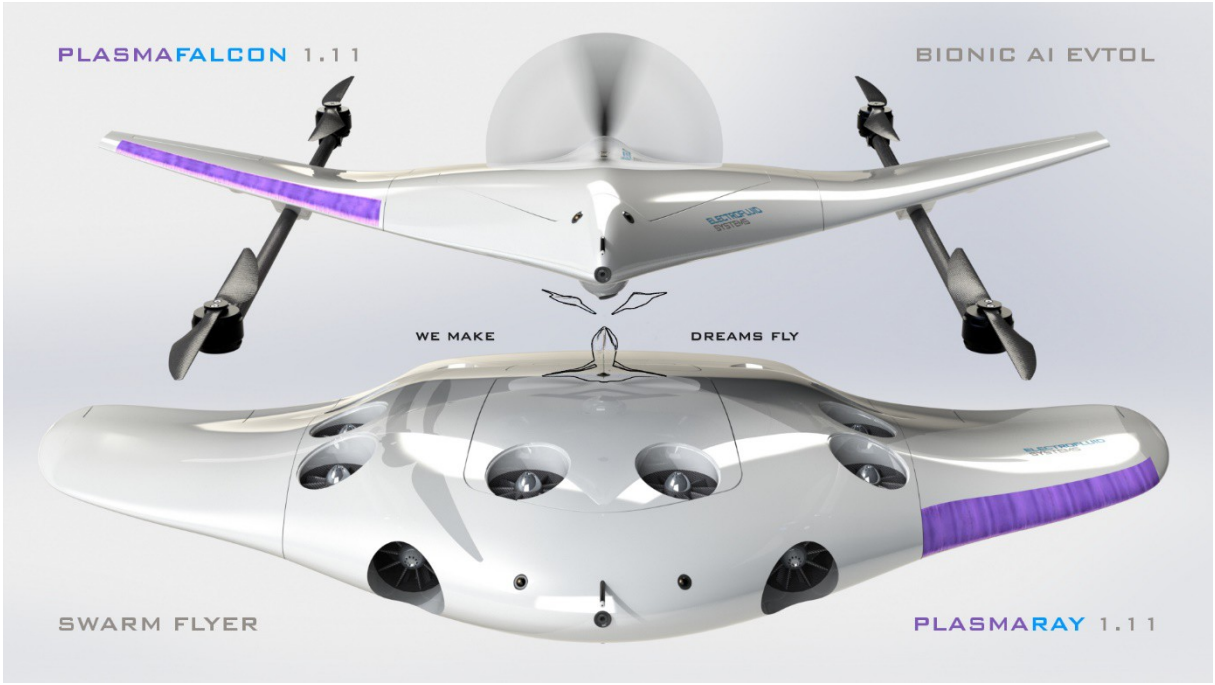

Fig. 3: *Swarm Flyer PlasmaFalcon 1.11 (on top) and PlasmaRay 1.11 (on bottom).*

7 minutes and 5 seconds. The multicopter was powered by an 800 W Intelligent Energy Fuel Cell Module and 390 grams of hydrogen stored in a 6-liter liquid hydrogen cylinder for up to 6500 Wh of electrical energy.

For the **PlasmaRay 1.11,** a special 0.8-liter tank can carry 52.0 grams of liquid hydrogen with electrical energy of 867 Wh. A standard 0.8-liter composite cylinder with 300 bar can only carry 16.5 grams of gaseous hydrogen and thus provides about 275 Wh of electrical energy as modern fuel cells have 40 - 60% efficiency. For the **PlasmaRay 1.11,** with an 800 W Intelligent Energy Fuel Cell, liquid hydrogen would provide an amazing amount of specific energy: a minimum of 325 Wh/kg, about two times higher than current LiPo batteries (see Fig. 4).

Fig. 4: *800 W Fuel Cell Module (Credit: Intelligent Energy).*

Package Drones H_2PlasmaRay 1.11 and PlasmaRay 1.11

The **H_2PlasmaRay 1.11** is a 1:6 scale model and technology demonstrator for a future air taxi with a 6.66 m wingspan (see Fig. 5 - 6). It is partly produced with laser sintering, and will use an 800 W fuel cell module from Intelligent Energy and a 0.8-liter 300 bar pressure tank with 16.5 grams of gaseous hydrogen as described before. The electrical energy is 275 Wh in gaseous form and 867 Wh in the liquid hydrogen case.

But why do we need hydrogen-powered flight vehicles? Today, the aviation industry produces about 115 grams of CO2 per passenger kilometer. This equals about 859 million tons of CO2 emission per year. The contribution to global CO_2 emissions is just 2% but is expected to double by 2030, and we really don't know the future impact of huge manned rockets for intercontinental and even interplanetary flights such as those promoted by SpaceX. We also don't know the future impact of rocket-powered suborbital spacecraft as promoted by companies like Virgin Galactic for the growing near-space to space tourism industry. Therefore, we need to look for disruptive technologies to replace our present jet engines and chemical rockets, even with efforts that are just step by step. Fuel cell technology is one way to reduce CO_2 emissions. It is a technology which presently provides more specific energy than average LiPo-batteries with 150 - 200 Wh/kg.

Fig. 5 - 6: *H_2PlasmaRay 1.11 with H_2-fuel cell and PlasmaRay 1.11 with LiPos only.*

Also, more powerful solid-state batteries are already on the way: Samsung recently unveiled new solid-state lithium metal batteries with an estimated specific energy of 360 Wh/kg. TeraWatt Technology announced a record-breaking specific energy of 432 Wh/kg (1122 Wh/l). Sion Power even talks about 650 Wh/kg. These new batteries will be commercially available in a few years from now and then they will help companies like Lilium to meet their goals, which may be challenging today but will certainly be possible in the near future. Just imagine: the limitations we may face today can change tomorrow as our ideas evolve based on new innovations such as the next generation fuel cells with 960 Wh/kg from HyPoint. Today, we are on the path to build electric drones that can fly 300 km at 300 km/h speed with a useful payload of 300 kg. Joby Aviation and Lilium might already cover two of those three parameters that we all dream of. To cover all three, we combine a drag-reduced flying wing design with a state-of-the-art hydrogen fuel cell technology from Intelligent Energy with at least 350 - 450 Wh/kg.

With the use of liquid hydrogen tanks, those "dream" parameters can even be extended from 300 to 1000 km and beyond to cover longer business routes, like Munich and London. We will see further details on this later in the discussion of the **H_2PlasmaRay 6.66**. On the way to developing hyperfast air taxis, we plan to use all scale-models from 1:6 (11 - 18 kg MTOW), 1:4 (25 - 40 kg MTOW), 1:3 (70 kg MTOW) to 1:2 (210 kg MTOW) as commercial package drones.

Wingcopter, for instance, is the fastest fixed-wing mini drone, with a Guinness World Record of 240 km/h. It is also the drone with the best weight-to-payload ratio among fixed-wing VTOLs on the market. The **PlasmaRay 1.11** (18 kg MTOW) and the bigger **PlasmaRay 1.66** (25 - 40 kg MTOW) have the potential to exceed all those numbers, setting new records (see Fig. 7, Tab. 1).

Fig. 7: H_2PlasmaRay 1.11 and PlasmaRay 1.11 with 11.1 - 17.7 kg MTOW.

Parameter	Wingcopter 178	PlasmaRay 1.11	H_2PlasmaRay 1.11
Wing span	1.78 m	1.11 m	1.11 m
Max. take-off weight	15.6 - 18.0 kg	17.7 kg	11.1 kg
Battery weight	4.0 kg	8.3 / 6.2 / 4.1 kg	2.0 kg
Fuel cell weight	-	-	2.4 kg
Empty weight	5.6 - 8.0 kg	5.4 kg	4.7 kg
Payload weight	2.0 / 4.0 / 6.0 kg	4.0 / 6.1 / 8.2 kg	2.0 kg
Range	100 / 85 / 45 km	175 / 125 / 75 km	95 - 225 km
Cruise speed	100 - 150 km/h	230 - 270 km/h	230 - 270 km/h
Top speed	240 km/h	300 km/h	300 km/h
Power available	700 Wh	1700 / 1275 / 850 Wh	700 – 1292 Wh
Battery power	700 Wh	1700 / 1275 / 850 Wh	425 Wh
VTOL power (2-3 min)	?	10360 W	7770 W
Cruise power	?	1680 W	1150 W

Tab. 1: *Comparison of Wingcopter 178 and PlasmaRay 1.11 / H_2PlasmaRay 1.11.*

Fig. 8 - 9: *Illustrations of possible package delivery with Swarm Flyers*

All types will have optional NVIDIA based Artificial Intelligent (AI) swarm controllers with six fisheye cameras to safely fly 6 - 13 flying wings (**Swarm Flyer**) in half-diamond (see Fig. 8 - 9) and full-diamond formations to reduce the overall drag by up to 65%. More details about our bionic swarm technology will be discussed at the Revolution.Aero Europe 2020 in London.

Today, it is not widely known that even birds use drag-induced electrostatic fields to control V-formation. Other insects like bumblebees apply electrokinetic effects to increase dynamic viscosity. It is still difficult to understand why they can fly at amazing Himalayan altitudes beyond 7,600 meters (25,000 feet). On this topic, our company Electrofluidsystems is truly inspired by nature and the motto is ***We Make Dreams Fly***.

For now, the **PlasmaFalcon** and **PlasmaRay** UAS do not use electroviscous effects at the micro- or nano-scale. However, all of our models will use dielectric barrier and sliding discharges to control separated air flow at high angles of attack (alpha) (see Fig. 10 - 11). Similar critical situations can also be induced at horizontal flight when strong crosswinds start to blow from underneath or come from sideways to induce dangerous flow separation at the outer wings. These are the most critical situations for flying wings. Plasma separation flow control helps to stabilize.

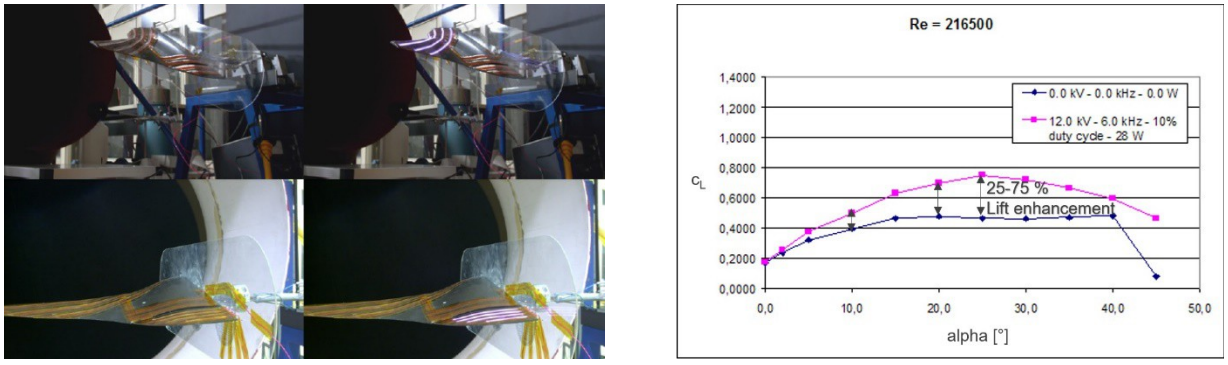

Fig. 10 - 11: *Lift (and drag) measurements of flying wing half model in a wind tunnel.*
https://www.youtube.com/watch?v=PcA-EqvgvDM&t=7s

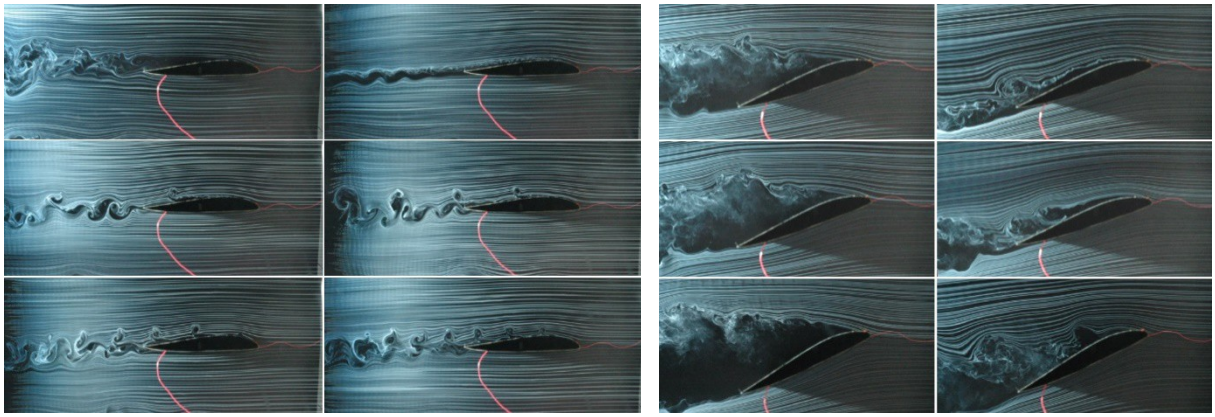

Fig. 12 - 13: *Smoke wire visualization of flow control using pulsed plasma actuators [3], [7].*

There are different plasma flow control techniques, which are discussed in our scientific papers, that can reduce drag and increase crosswind stability by 60% and more. Pulsed plasma actuators, for instance, can cause lift enhancement by 25%-75 % and drag reduction by 10%-20 % (see Fig. 10 - 11). Pulsed electric wind induces rolling cylinder vortices that run over the wings and keep the air attached even at very high angles of attack (see Fig. 12 - 13) [2-7]. At normal cruise conditions, there is still some lift enhancement, by 10%-15%, and drag reduction, by 5%-10 %.

These are all techniques which, when necessary, would enable our Plasma Flyers to glide at very high altitudes just by "flapping" the fields. Special nanosecond pulsed plasma actuators would then be used for anti- and de-icing means. Plasma control techniques will also be used on **PlasmaFalcon** propellers and **PlasmaRay** lift-fans to make them more efficient and operative at high altitudes that now are usually only reachable by MALE or HALE type UAVs.

The mid-term vision for 2023 - 2025 is to have UAS products with 1.66 m, 2.22 m, 3.33 m and 6.66 m span widths as 1:4, 1:3, 1:2 and 1:1 technology demonstrators for the future hyperfast air taxis **H_2PlasmaRay 6.66**, **H_2PlasmaRay 8.88**, **H_2PlasmaRay 11.1** and **H_2PlasmaRay 13.3 Strato.**

Passenger Drones (Air Taxis) H_2PlasmaRay 6.66 to H_2PlasmaRay 19.9

H_2PlasmaRay 6.66 is an electric vertical take-off and landing (eVTOL) air taxi with a maximum take-off-weight (MTOW) of 900 kg. It has a bionic Stingray-shaped flying wing design with two separate propulsion units for VTOL and cruise (see Fig. 14 - 15). A distributed propulsion of 10 Schübeler electric ducted fan (EDF) jets, each 195 mm in diameter, is used for horizontal flight. 38 EDF jets are used for vertical take-off and landing (VTOL). These jets can generate 950 kg of static thrust in continous mode or 1050 kg for a short period of time. The **H_2PlasmaRay** will have landing gears similar to those of the Rhaegal drone of Sabrewing to enable alternative starts from runways and emergency landings on highways. The avionics is inspired by Thales FlytX and will use several touchscreens and a central joystick for optional pilot control (Fig. 16 – 19).

Future cargo versions will alternatively use six plasma flow controlled lift-fans for eVTOL-mode in a similar way as shown by Valkyrie Systems Aerospace for the Eagle Hoverjet.

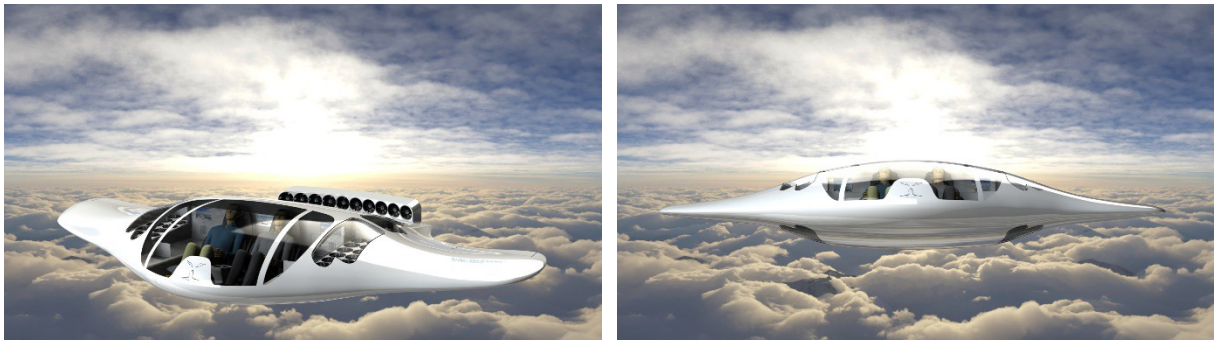

Fig. 14 - 15: *Side and front view renderings of H_2PlasmaRay 6.66.*

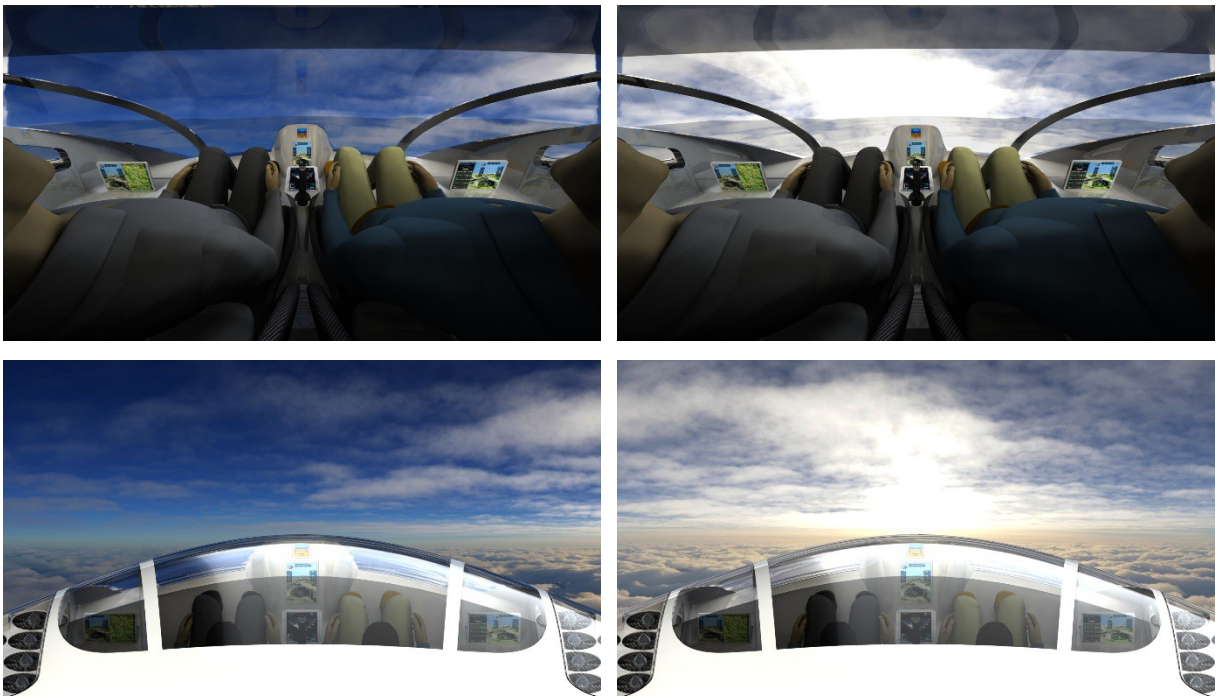

Fig. 16 - 19: *Cockpit visualizations of H_2PlasmaRay 6.66 with optional pilot control.*

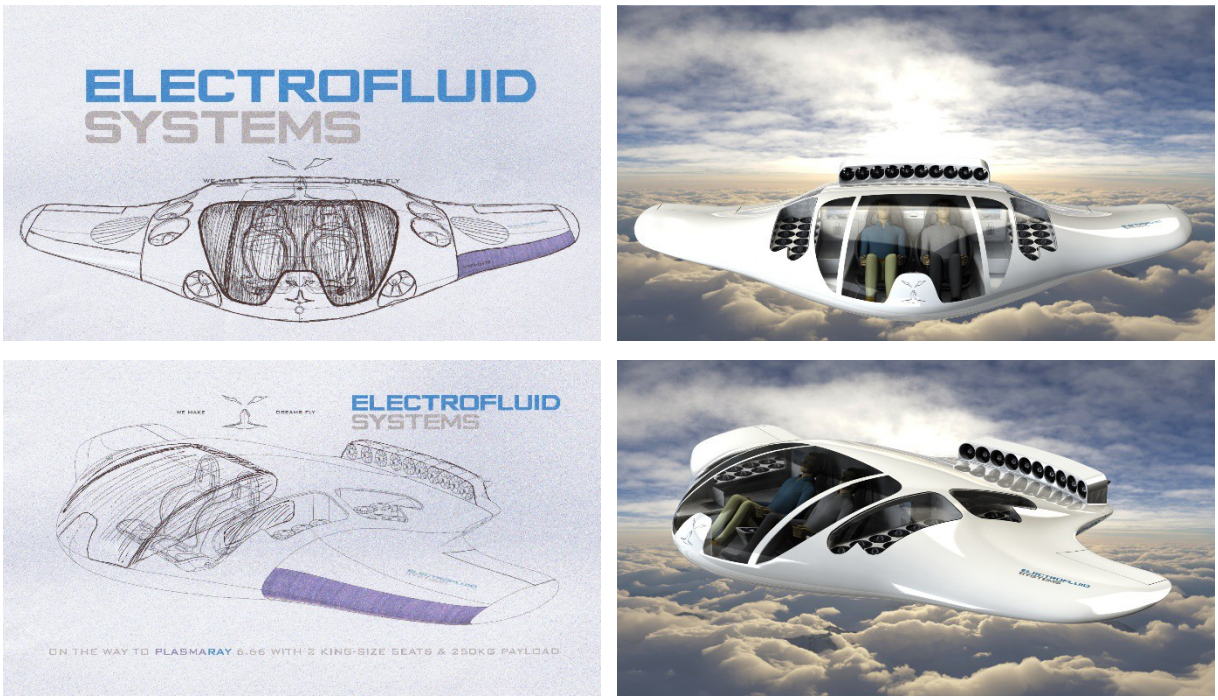

Fig. 20 - 23: *Comparison of first drawings (2019) with final concept of H_2PlasmaRay 6.66 (2020).*

Parameter	Lilium 2-Seater	H_2PlasmaRay 250	H_2PlasmaRay 300
Wing span	6.00 m	6.66 m	6.66 m
Max. take-off weight	690 kg	900 kg	900 kg
Battery weight	240 kg	137 kg	-
Fuel cell weight	-	81 kg (48 kW)	122 kg (72 kW)
H_2-Tank weight	-	82 kg	123 kg
H_2 weight (gaseous)	-	3.8 kg (152 l, 379 bar)	5.7 kg (228 l, 379 bar)
Empty weight	250 kg	346 kg	350 kg
Payload weight	200 kg	250 kg	300 kg
Range	200 km	250 km	300 km
Cruise speed	250 km/h	250 km/h	300 km/h
Top speed	270 km/h	270 km/h	322 km/h
Power available	38 kWh	83 kWh	95 kWh
Battery power	38 kWh	20 kWh	0 kWh
VTOL power (4 min)	432 kW	526 kW	526 kW
Cruise power	28 kW	46 kW	61 kW

Tab. 2: *Comparison of Lilium 2-seater and H_2PlasmaRay 6.66 - 250 / 300.*

Lilium previously worked on a 2-seater with an approximate 6 m wingspan. Below (Tab. 2), you can find estimated parameters of the Lilium prototype compared with our 2-seater **H_2PlasmaRay 6.66**.

The next bigger **H_2PlasmaRay 8.8** will be a 5-seater with an 8.8 m wingspan and 1,850 kg MTOW as a direct competitor to fast flyers like Joby Aircraft S4 and Lilium Jet. A cargo version could easily carry 1,000 lbs (454 kg) and would be a short- to mid-range competitor to Rhaegal RG-1. **H_2PlasmaRay 11.1** would have a MTOW of 3,000 kg, **H_2PlasmaRay 13.3** of 5,700 kg, **LH_2PlasmaRay 18.0 Strato** of 10,500 kg and **LH_2PlasmaRay 19.9 Strato** of 13,500 kg with a cargo volume of up to 4.5 tons when used as long range transport drone.

Depending on speed, range and payload the **H_2PlasmaRay** will use LiPo batteries with +20 kWh and 10 - 15 Intelligent Energy 4.8 kW fuel cells units. Similar Intelligent Energy fuel cells were used by Boeing Phantom Works to achieve the world's first hydrogen manned flight in 2015.

Fig. 24: *4.8 kW Fuel Cell Module (Credit: Intelligent Energy).*

The specific energy is 378 Wh/kg with gaseous and +1,000 Wh/kg with liquid hydrogen. **H_2PlasmaRay 6.66 - 250 / 300** could store about 12 / 18 kg of liquid hydrogen which would provide about 200 / 300 kWh of electrical energy (see Fig. 25 – 33). Therefore, a **LH_2PlasmaRay 6.66 - 250 / 300** would have an amazing **range of 1,000 / 1,300 km**. Just imagine the range of bigger **LH_2PlasmaRay**s, which from **LH_2PlasmaRay 13.3** on will also be platforms for our novel air-breathing magneto-plasma jet propulsion and thus future near-space tourism applications [5].

'***Water will be the coal of the future.***' Jules Verne, The Mysterious Island , 1874 [1].

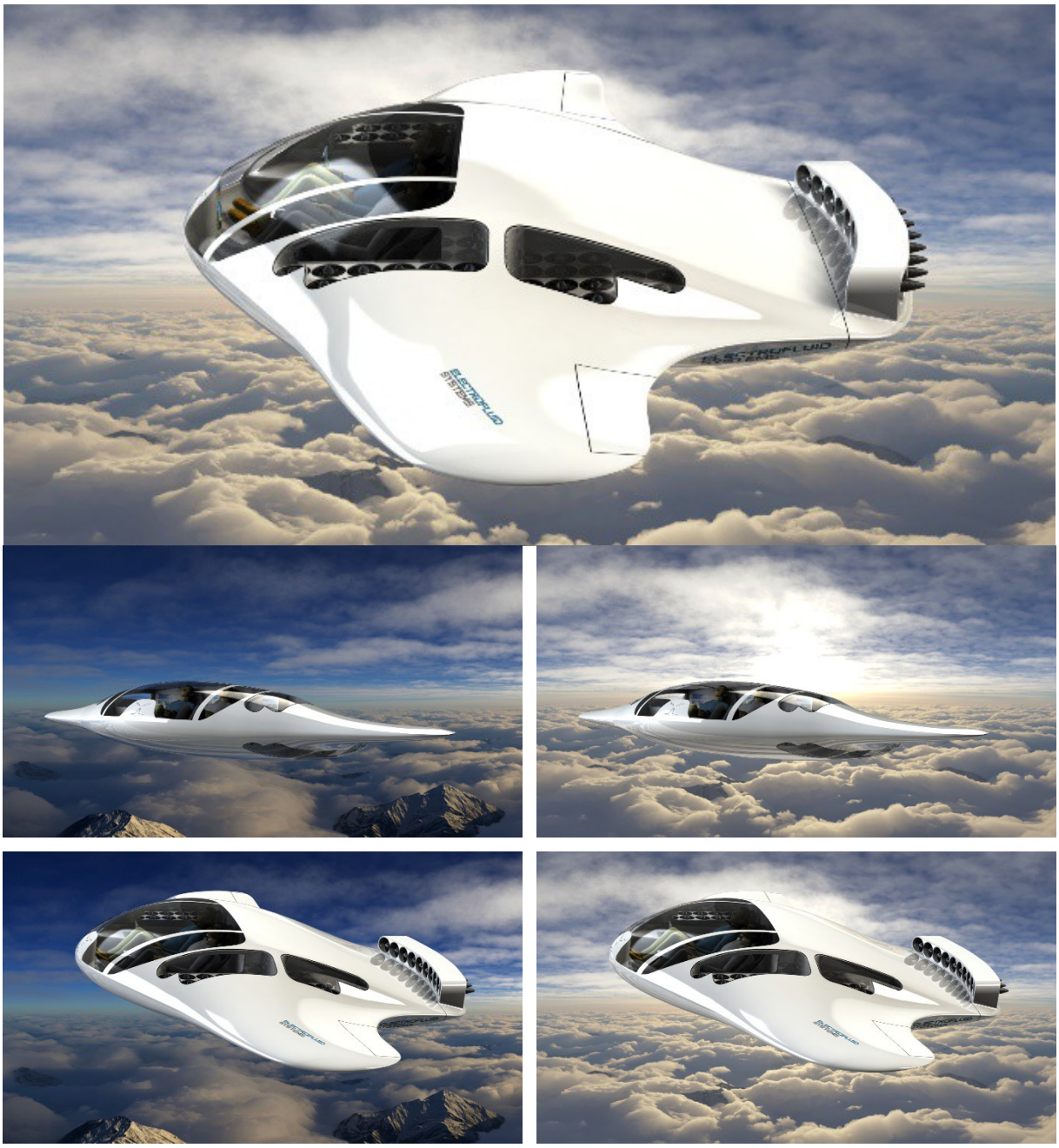

Fig. 25 - 29: *More side-view renderings of H_2PlasmaRay 6.66.*

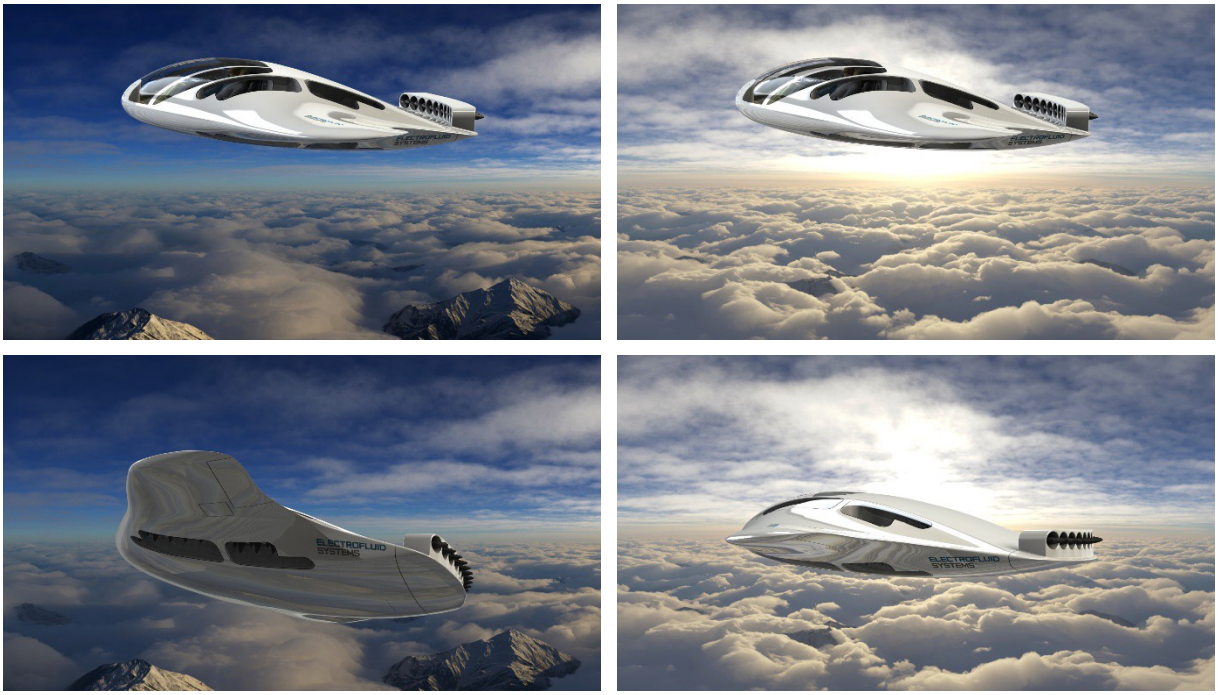

Fig. 30 - 33: *More side-view renderings of H_2PlasmaRay 6.66.*

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