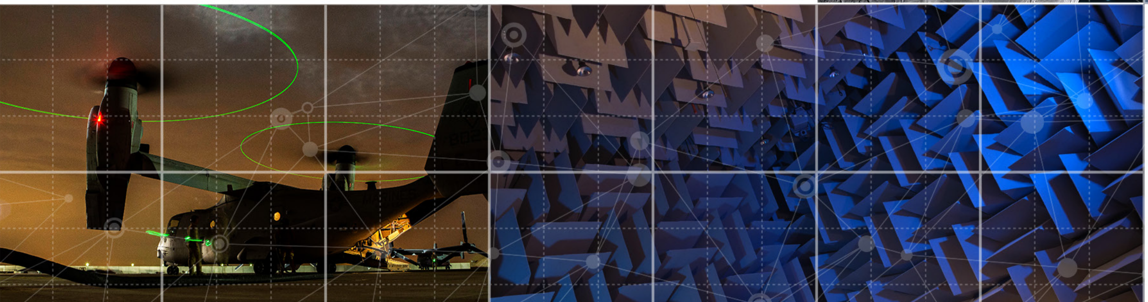
DISTINGUISHED SPEAKER SERIES

2020–2021



AIAA

SHAPING THE FUTURE OF AEROSPACE

Table of Contents

Section **Page**

Distinguished Speaker Series Introduction and FAQs 4
Virtual Event Guidelines 5
Speaker PPT Presentation and Video/Webcast Release Form 7
Tips to Make Your Virtual Meeting a Success 8

Distinguished Speakers

Adamo, Daniel R. 9
Astrodynamics Consultant
Interplanetary Cruising with Earth-To-Mars Transit Examples
***Aquarius*, a Reusable Water-Based Interplanetary Human Spaceflight Transport**
Questioning the Surface of Mars as the 21st-Century's Ultimate Pioneering Destination in Space
Potential Propellant Depot Locations for Beyond Low Earth Orbit (LEO) Human Transport
Forty Years on the Bleeding Edge of Technology from an Aerospace Engineer's Perspective
Exploring the Solar System Through Low-Latency Telepresence (LLT)

Barber, Todd 11
Senior Propulsion Engineer, NASA Jet Propulsion Laboratory
Red Rover, Red Rover, Send Curiosity Right Over
Lord of the Rings: Cassini Mission to Saturn
Voyager 1 & 2: Humanity's Most Distant Explorers
Putting the “P” in “JPL”: The Past, Present, and Future of Propulsion at NASA Jet Propulsion Laboratory

Bevilaqua, Paul 13
Technical/Research Director, Lockheed Martin Aeronautics Company (Retired)
Inventing the Joint Strike Fighter

Bibel, George 14
Professor of Mechanical Engineering, University of North Dakota
Beyond the Black Box: The Forensics of Airplane Crashes

Bowman, Alice 15
Missions Operation Manager, New Horizons Mission, Johns Hopkins University Applied Physics Laboratory
Mission to Pluto

Brown, Jim 16
Chief Operations Officer and Test Pilot Instructor, National Test Pilot School
MiG-21 and MiG-23 Qualitative Evaluations
Flying Lockheed’s Stealth Fighters

Cavera, Jim 17
Senior Engineer, Blue Origin
Future Propulsion: Nuclear Fission, Fusion, and Beyond

Evans, Michelle 18
President, Mach 25 Media
The X-15 Rocket Plane: Flying the First Wings into Space
In the Line of Duty: Michael Adams and the X-1

Fleeman, Gene 20
Missile Design, Development and System Engineering
Key Drivers in the Missile Design, Development, and System Engineering Process
My Career in Aerospace Engineering and a Soda Straw Rocket Science Design, Build, and Fly Competition

Gruntman, Michael 22
Professor of Astronautics, University of Southern California
The Road to Space: The First Thousand Years
Intercept 1961: From Air Defense SA-1 to the Birth of Soviet Missile Defense

Hallion, Richard P. 23
Research Associate in Aeronautics, National Air and Space Museum
The High-Speed Revolution: How Aviation Progressed from the Subsonic to the Hypersonic Era
A Century of Military Aviation
Naval Aviation: The First Hundred Years
Global Aviation in the Interwar Era
Air Power in the First World War
Air Power in the Second World War
The History of Hypersonics
Air Dominance: The Enduring Requirement
China's Rise as an Aerospace Nation
Aviation's Impact and Development during the First World War
Rolling Thunder Fifty Years On: The Genesis, Evolution, and Impact of America's Most Controversial Air Campaign

Hamilton, Tucker 25
Experimental Fighter Test Pilot, USAF
Making a Difference at Mach 1
F-35 Flight Test
Automatic Air Collision Avoidance System Testing
Break the Store Not the Airframe: CFP Testing in a 30-Year-Old Envelope
F-15E TRIDENT Missile Surrogate Tests
First-Ever Missile Shot at 1.2M/7Gs…What Could Go Wrong!?

Horkovich, Jim 28
Chief Technical Architect for High Power Laser Programs, Raytheon Missile Systems
Directed Energy Weapons; Promise & Reality (Myths, Legends, and Facts: Reflections of a "Star Warrior"

Meholic, Greg 29
Design Engineer, The Aerospace Corporation
Advanced Space Propulsion Concepts for Interstellar Travel

Melamed, Nahum 31
Project Leader, The Aerospace Corporation
Planetary Defense from Asteroids and Comets
Asteroid Deflection Class – Hands-on
Applying GN&C Solutions to the Problem of Asteroid Interception for Planetary Defense
Intercept and Engagement of the PDC 2019 Comet with Solar Sailcraft

Szalai, Kenneth J. 33
Aerospace Consultant; Director, NASA Armstrong Flight Research Center (Retired)
Flights of Discovery – Impact and Lessons from Experimental Flight Research at the NASA Neil Armstrong Flight Research Center

Vono, Charles T. "Charlie" 35
Fundamentals of Complex System Sustainment
In-Flight Refueling the SR-71 During the Cold War
How Do Our Nation's ICBMs Work?

Wessen, Randii R. 36
Program System Engineer, Project Planning Office, NASA Jet Propulsion Laboratory
The Future of U.S. Planetary Exploration
Market-Based Systems for Solving Space Exploration Resource Allocation Problems
The Astronomical Search for Origins and Planetary Systems

Winn, Robert C. "Bob" 38
Principal and Director of Colorado Operations, Engineering Systems Inc. (ESI)
Animations Versus Simulations
The Cold Truth about Aircraft Icing
The Collapse of Big Blue
Anatomy of an In-Flight Breakup
New Tools in Aircraft Accident Reconstruction
Accident Reconstruction Needs Data – Where to Get It and How to Use It

Zubrin, Robert 40
Founder and President, The Mars Society
Destination Mars: Human Mars Exploration & Colonization / Humans to the Red Planet Within a Decade

Distinguished Speaker Series Introduction and FAQs

What is the Distinguished Speaker Series?
The Distinguished Speaker Series, formerly known as the Distinguished Lecture Program, offers AIAA Professional Sections and Student Branches the opportunity to select a speaker from a prescreened AIAA list. The speakers are considered experts on a specific topic, and oftentimes have won national awards. Since 1969 this program has been a resource for section and student branch officers to provide an expert in a particular area of interest to their members.

When is the Distinguished Speaker Series available?
The program runs all year. Speakers are updated in the listing in the fall.

Is this program in person or virtual?
This program has historically been held in person and speakers traveled to sections and student branches to speak. As of April 2020 due to COVID-19, the program was made fully virtual for the health and safety of the speakers and sections/student branches. AIAA will be looking into a hybrid of in-person and virtual options for the future.

What online platform does AIAA recommend for this program?
AIAA recommends using Zoom to host these speaking engagements, as it is a preferred vendor of AIAA.

Does my section/student branch need to fund the speaker?
While the program is all virtual, speakers do not receive funding to participate in the events. For in-person speaking engagements, the speakers receive an honorarium for their travel expenses.

How many speakers can my section/student branch host from this program?
While the program is all virtual, there is no limit to how many speakers a section or student branch can have throughout the year.

What is the process for accessing a speaker through this program?

1. The section or student branch contacts the speaker they would like to invite, and agree upon a date and time for the event.
2. The section or student branch must then obtain authorization from AIAA Staff before the speaker is confirmed. For authorization, email Lindsay Mitchell at lindsaym@aiaa.org.
3. After approval is secured from AIAA, the section or student branch may confirm the speaker's invitation and schedule the meeting on Zoom. Please follow the "Virtual Event Guidelines" on Page 5 to help you set up your virtual meeting.
4. Provide this info to the speaker in addition to Lindsay Mitchell for tracking purposes.
5. Following the event, sections/student branches must provide a summary of the event to Lindsay Mitchell to include information on number of attendees, how the presentation went, and any concerns or technical difficulties that occurred.

Virtual Event Guidelines

During the COVID-19 pandemic, the Distinguished Speaker Series is fully virtual until in-person gatherings and speaker travel is deemed safe by scientific professionals. Virtual events are not a permanent substitution for the program, but a temporary one. AIAA is looking into continuing a virtual component of the program once in-person gatherings are considered safe.

AIAA recommends using Zoom to host the events. If you have not used Zoom, you can find tutorials and tips at the Zoom Help Center. Please refer to the Zoom Security Guidelines sent by AIAA staff to be sure your meeting is secure. AIAA will also share the promotion of your virtual events to AIAA members so the program can receive maximum visibility.

Below are some guidelines to keep in mind for your virtual Distinguished Speaker events.

Before Your Meeting

- AIAA recommends using a Zoom “meeting” versus a “webinar” to make the event more interactive.
- We encourage you to record the meeting so that your section or student branch has a record and if you want to share with members following the event.
- Your speaker will need to complete and sign a Speaker Presentation & Video/Webcast Release Form. See Page 7 for a copy of the form to send to the speaker.
- Once you have scheduled the Zoom meeting with the speaker, please notify Lindsay Mitchell at lindsaym@aiaa.org with details and the completed and signed speaker release form.
- AIAA encourages you to post the event on Engage. However, do not post the Zoom URL, as this can be a security risk. Only share the link with those that RSVP or request the link. You can do this by creating an event on Engage and selecting “Free event/Meeting including ability to RSVP but no payment” where people can RSVP to the event. Once individuals RSVP, you may provide them with the link.
- Check with the speaker to see if they plan on using slides or visuals as part of their presentation and be sure to collect them ahead of the meeting or allow them to screenshare during the event.
- Establish who from your section/student branch will be the “Host” of the meeting and introduce the speaker. Additionally, designate someone to be the “Cohost” of the meeting to monitor activity on Zoom in case there is anything inappropriate that occurs.
- The maximum capacity for a Zoom meeting is 500 participants. Once your meeting reaches 500, no more participants will be allowed to enter the meeting.

During Your Meeting

- When the meeting begins, designate the speaker and the individual who is monitoring participant activity as a “Co-Host.”
- Begin the event a minute or two past the start time to allow participants to log into the meeting.
- Before recording the meeting, please let participants know you are recording and that it will be shared with AIAA.
- At the beginning of the meeting, the moderator should set expectations of the event format and to remind participants to save Q&A until the end. This is to prevent participants from interrupting the

speaker or talking over one another. Participants may ask questions using the “Raise Hand” feature or in the Chat.

- The “Host” should use “screenshare” if the speaker has slides or a visual presentation.
- Lock the meeting 10-15 minutes after it begins.

After Your Meeting

- Contact Lindsay Mitchell at lindsaym@aiaa.org with the link to the recording, your feedback, and any feedback received from participants or the speaker. AIAA will use the recording and your feedback for archival purposes.

SPEAKER PPT PRESENTATION and VIDEO/WEBCAST RELEASE FORM

For and in consideration of my engagement as a speaker by the American Institute of Aeronautics and Astronautics ("AIAA"), I hereby give AIAA, its employees, agents, representatives, and assigns the right to encode, store, edit, publish, and distribute photographs, presentation materials, video recordings, and/or audio recordings of me, through any media, including when used together with any printed matter.

I hereby waive any right to inspect or approve any video or audio materials, any photograph, any advertising copy or other printed matter, or any particular use of any such materials.

I hereby release, discharge, and agree to hold harmless AIAA, its employees, agents, representatives, and assigns from any liability as a result of their use of such materials, in particular due to any inadvertent or unintentional distortion or blurring that occurs in the management of such materials.

I hereby certify that I am over 18 years of age and competent to contract in my own name in so far as the above is concerned. (If not, cross out and have parent or legal guardian sign.)

Name (print): ____

Address: Street: ____

City: ____

State: ______________________________ Zip: ____________________

Phone: ____

E-mail: ____

Signature and Date: ____

____

Please complete form and return via email no later than the event.

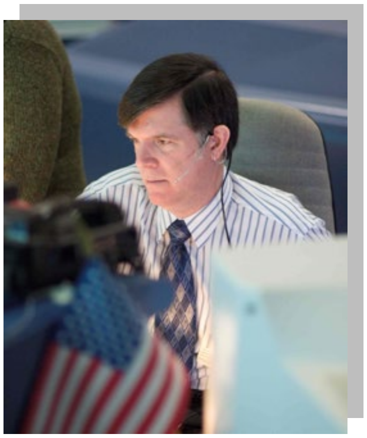
Tips to Make Your Virtual Event A Success

Confirm with the Speaker:
• Event date/time
• Zoom link/call-in details
• Format of event (length of presentation, Q&A, introductions, etc.)
• Number of attendees expected and what type of audience
• Any details on practice sessions
• Tell the speaker if you have a special purpose, anniversary, etc., on the day of the event
• Ask for some background information for an introduction, such as a bio, headshot, or anything to be used to promote the event

Day of Event:
• Check in with the speaker earlier in the day to confirm their participation at the event.
• Login to the Zoom meeting 10-15 minutes prior to the start time to ensure everything looks fine and that any slides, videos, and audio are working properly.

Event:
• Begin the recording when you are ready to welcome and introduce the speaker.
• When you are ready for the presentation to begin, introduce the speaker using a script or bio approved by the speaker beforehand. One or two minutes are plenty. Describe the speaker and why he/she is qualified to speak on this subject.
• Take note of how many people are in attendance and take any screenshots.
• Once the speaker is finished with the presentation and ready for questions, be sure to prompt the audience to ask questions and moderate anyone who is raising their hand or have questions in the Chat.
• When the event concludes, thank the speaker and audience for attending.

After the Event:
• Send a follow-up email/letter to the speaker thanking them for their presentation and any positive feedback received from attendees.
• Send a quick follow-up with AIAA Staff Lindsay Mitchell lindsaym@aiaa.org to report how the event went, how many individuals attended, and any feedback worth sharing.



DANIEL R. ADAMO

Email: adamod@earthlink.net

Biography:
Mr. Adamo is an astrodynamics consultant focused on space mission trajectory design, operations, and architecture. He works with clients primarily at NASA and in academia.

Until retirement in 2008, Mr. Adamo was employed by United Space Alliance as a trajectory expert, serving as a “front room” flight controller for 60 Space Shuttle missions. Along with console duties during simulations and missions, this job entailed development of trajectory designs, software tools, flight rules, console procedures, and operations concepts. Mr. Adamo began his career at the Perkin-Elmer Corporation where he developed and operated proof-of-concept software for computer-controlled polishing of optical elements. He has degrees in Physical Sciences and Optical Engineering from the University of Houston and the University of Rochester, respectively.

Mr. Adamo is an AIAA Associate Fellow and the author of many publications (ref. http://www.aiaahouston.org/adamo_astrodynamics/). He has received numerous awards, including 14 NASA Group Achievement Awards.

Abstract: “Interplanetary Cruising with Earth-To-Mars Transit Examples”
This 1.5-hour lecture introduces the fundamentals of orbit motion and applies them to designing a realistic Mars mission by solving the *Lambert boundary value problem* for sun-centered trajectories. The *patched conic* technique is then applied to a sun-centered transit from Earth to Mars, producing geometric constraints on Earth departure as an example. Summarizing this process, the fundamental design trade between minimal time-of-flight and minimal propulsion is made apparent for missions to the moon, near-Earth asteroids, and Mars. By listening to this lecture, anyone with an understanding of high school physics will become familiar with the challenges of interplanetary spaceflight, particularly when human factors are considered.

Abstract: “*Aquarius*, a Reusable Water-Based Interplanetary Human Spaceflight Transport”
This 1.5-hour lecture reviews major challenges to interplanetary human spaceflight and suggests strategies by which they may be addressed. These strategies include pre-emplaced Earth return consumables at the interplanetary destination, water used as a high-efficiency/high-thrust propellant also serving as crew radiation shielding, and transport servicing in a distant retrograde orbit about the moon. Applied to a hypothetical transport christened *Aquarius*, the strategies are shown to enable routine and sustainable roundtrips between Earth and Deimos, the outer moon of Mars. Knowledge gaps pertaining to *Aquarius* are identified with the intent of motivating changes in current technology roadmaps. After listening to this lecture, anyone with interplanetary human spaceflight interests will be conversant with associated technology issues and plausible means by which they might be resolved.

Abstract: "Questioning the Surface of Mars as the 21st Century's Ultimate Pioneering Destination in Space"
This 1.5-hour lecture reviews historic earthly distinctions between exploring and pioneering before applying these distinctions to destinations in space. Although a case can be made for human and robotic *exploration* in space, there is as yet no compelling rationale for "putting down roots" to *pioneer* anywhere off Earth. Why then is the surface of Mars widely accepted as humanity's future "home away from home" to the extent some 200,000 people are willing to attempt forming a permanent colony there? There is no evidence suggesting humans can survive on the surface of Mars long-term,

let alone thrive there to produce viable offspring. A variety of evidence is presented to affirm the surface of Mars is a sociocultural destination whose suitability for human pioneering is based on more than a century of fictional literature and poorly informed research as the Space Age dawned. More current knowledge of the "unexplored country" in our Solar System suggests small bodies such as asteroids and the moons of Mars are humanity's best hope for pioneering off Earth this century.

Abstract: “Potential Propellant Depot Locations for Beyond Low Earth Orbit (LEO) Human Transport”

This 1.5-hour lecture first presents historic examples of transportation depots, including a propellant depot currently operating in LEO. Operational and geometric insights governing the utility of LEO depots are then developed for cislunar and interplanetary destinations. These insights lead to the assertion that a depot located near the end destination supports the most efficient human transport operations, particularly if relevant resources are available locally. Depot logistics provided by launch vehicles with contrasting lift capabilities are explored and found to produce different architectural challenges. Less capable launch vehicles tend to face challenges in space-based operations, while more capable launch vehicles tend to face challenges in ground-based operations.

Abstract: “Forty Years on the Bleeding Edge of Technology from an Aerospace Engineer’s Perspective”

How did a kid living amid New Hampshire farm fields progress to serve on console in Houston’s Mission Control during 60 Space Shuttle missions? This 1.5-hour autobiographic lecture follows an aerospace career from its roots in the 1970s to present-day freelance consulting on space exploration missions and architectures. Along the way, key lessons learned are debriefed with regard to developing, operating, and managing aerospace systems. The lecture concludes with experience-based advice on starting an aerospace career.

Abstract: “Exploring the Solar System Through Low-Latency Telepresence (LLT)”

Why would it make sense to send humans more than 99% of the way to an off-Earth exploration destination like Mars without putting “boots on the ground”? How can average speeds achieved by robotic Mars rovers, typically a leisurely 0.4 meters per hour, be dramatically increased? This 1.5-hour lecture will answer these questions by suggesting humans operate in synergy with nearby robotic systems as a game-changing space exploration strategy. When command/feedback delays between human explorers and their robotic proxies are reduced sufficiently, today’s user interface technology can impart multi-sensory impressions of “being there,” a state of cognizance called low-latency telepresence (LLT). Using LLT-based strategies, impressive exploration productivity gains are realizable, together with reduced programmatic cost and risk, when compared to more conventional exploration strategies based on the Apollo Program circa 1970. These benefits accrue regardless of whether humans orbit above or loiter on/beneath a nearby exploration region.

TODD BARBER

Email: todd.j.barber@jpl.nasa.gov

Biography:

Mr. Barber is a JPL senior propulsion engineer, who worked as lead propulsion engineer on the Cassini mission to Saturn following part-time work on the Mars Exploration Rover (MER) mission, Deep Impact mission, and the Mars Science Laboratory (MSL) mission, which landed the large rover Curiosity on the red planet on 5 August 2012. Cassini was launched on 15 October 1997 on its two-billion-mile, seven-year journey to the ringed planet. The MER team launched launch twin rovers to the red planet in June and July 2003, and Opportunity is still going strong over nine years after landing. Mr. Barber also worked as the lead impactor propulsion engineer on Deep Impact, which successfully crashed into Comet Tempel-1 on Independence Day 2005, at 23,000 miles per hour.

Mr. Barber worked on the Galileo project for over seven years and his primary responsibility was getting Galileo into Jupiter orbit on 7 December 1995. He also worked part-time on the Space Infra-Red Telescope Facility (SIRTF) mission and on the Stardust mission, as well as the Mars Sample Return mission and a Mars airplane study. Mr. Barber received NASA's Exceptional Achievement Award in 1996 for his work on Galileo. He also worked three years on the Deep Space One mission, the first NASA mission to use electric propulsion (a la “Star Trek”). This mission included flybys of a near-Earth asteroid, Braille, and a comet named Borrelly.

Mr. Barber is a native of Wichita, Kansas, and attended MIT between 1984 and 1990, obtaining B.S. and M.S. degrees in aerospace engineering, with a humanities concentration in music. He is also a composer of church choral music, with two pieces published to date. His hobbies include singing charitably and professionally, playing the piano, visiting all the U.S. tri-state corners and national parks, playing basketball (though it’s been a while), and amateur astronomy.

Abstract: “Red Rover, Red Rover, Send Curiosity Right Over”

Curiosity's mission to the red planet will be covered in detail. Topics to be discussed include a bit on the history of Mars rovers at JPL, the scientific motivation for Curiosity, and the preparations for launch two days after Thanksgiving in 2011. The science suite on board this one-ton mega rover will be presented, as well as the engineering challenges involved in getting Curiosity to the launch pad, traveling 352 million miles to Mars over 8.5 months, and “sticking the landing” following the so-called “seven minutes of terror” on 5 August 2012. Early mission science results will be presented as well, followed by pop-culture reaction to the rover landing.

Abstract: “Lord of the Rings: Cassini Mission to Saturn”

Cassini’s mission to the ringed planet will be covered in detail. Topics covered include the Cassini spacecraft design, trajectory to Saturn, cruise science results, Saturn Orbit Insertion, and science results from the four-year prime mission. Discussions of the two-year extended mission (the Cassini Equinox Mission) and seven-year doubly extended mission (the Cassini Solstice Mission) will be covered as well. Images and videos highlighting Cassini results at Saturn will be presented, covering Cassini’s five co-equal science objectives of understanding Saturn’s rings, magnetosphere, icy satellites, large moon Titan, and Saturn itself.

Abstract: “Voyager 1 & 2: Humanity's Most Distant Explorers”
The Voyager mission to the outer planets and interstellar space will be discussed in detail. Topics to be discussed include the incredible opportunity for a "grand tour" of the outer planets only encountered every 176 years and some true "postcards from the edge" at Jupiter, Saturn, Uranus, and Neptune. The interstellar mission and current status will also be highlighted as well, particularly the challenges of flying two geriatric spacecraft with a tiny flight team. Finally, the future of the mission and the Voyager Golden Record will be featured in some detail as well.

Abstract: “Putting the ‘P’ in ‘JPL’: The Past, Present, and Future of Propulsion at NASA Jet Propulsion Laboratory”
From modest beginnings in the era of early liquid rockets through state-of-the-art propulsion systems flown on 21st-century spacecraft, propulsion technologies have advanced dramatically through the decades. Over three quarters of a century of propulsion experience at NASA Jet Propulsion Laboratory will be discussed chronologically, including innovative practices in solid and liquid propulsion now considered the status quo. These propulsion advancements will be discussed in the context of early JPL propulsion history before NASA formed in 1958, along with a myriad of robotic lunar and planetary missions since the 1960s.

PAUL BEVILAQUA

Email: pbevilaqua@sbcglobal.net

Biography:
Dr. Bevilaqua has spent much of his career developing Vertical Take Off and Landing aircraft. He joined Lockheed Martin as Chief Aeronautical Scientist and became Chief Engineer of the Skunk Works, where he played a leading role in creating the Joint Strike Fighter. He invented the dual cycle propulsion system that made it possible to build a stealthy supersonic VSTOL Strike Fighter, and suggested that conventional and naval variants of this aircraft could be developed to create a common, affordable aircraft for all three services. He subsequently led the engineering team that demonstrated the feasibility of building this aircraft.

Prior to joining Lockheed Martin, he was Manager of Advanced Programs at Rockwell International's Navy aircraft plant, where he led the design of VSTOL interceptor and transport aircraft. He began his career as an Air Force officer at Wright-Patterson AFB, where he developed a lift system for an Air Force VSTOL Search and Rescue Aircraft. He received degrees in Aeronautical Engineering from the University of Notre Dame and Purdue University.

He is an AIAA Fellow of and a member of the National Academy of Engineering. He is also the recipient of a USAF Scientific Achievement Award, AIAA and SAE Aircraft Design Awards, AIAA and AHS VSTOL Awards, and Lockheed Martin AeroStar and Nova Awards.

Abstract: "Inventing the Joint Strike Fighter"
This presentation will describe the technical and program challenges involved in developing the F-35 Joint Strike Fighter and show how an innovative idea became an international program with engineers from half a dozen countries developing a single replacement aircraft for multiple aircraft types. The F-35 Joint Strike Fighter was developed to meet the multirole fighter requirements of the U.S. Air Force, Navy, Marine Corps, and our allies. The Air Force variant is a supersonic, single engine stealth fighter. The Navy variant has a larger wing and more robust structure in order to operate from aircraft carriers, while the Marine Corps variant incorporates an innovative propulsion system that can be switched from a turbofan cycle to a turbo shaft cycle for vertical takeoff and landing. This propulsion system enabled the X-35 to become the first aircraft in history to fly at supersonic speeds, hover, and land vertically. The development team won the Collier Trophy, which recognizes "the greatest achievement in aeronautics or astronautics in America" each year, for this accomplishment.

GEORGE BIBEL

Email: gbibel@gmail.com

Biography:

Mr. Bibel is the author of *Beyond the Black Box: The Forensics of Airplane Crashes*. The book teaches high school science with unusual and interesting airplane accidents. The book, featured in the *RAF News*, was favorably reviewed by *New Scientist*, the *New York Times*, and *Discovery Magazine*. *Beyond the Black Box* was also expanded into a training seminar presented at Boeing. Bibel, a professor of mechanical engineering at the University of North Dakota, has just completed a second book on aviation accidents with an airline pilot co-author.

Presentation: "**Beyond the Black Box: The Forensics of Airplane Crashes**"

The presentation is based on a collection of outstanding graphics with an occasional crash video.

ALICE BOWMAN

Email: Alice.Bowman@jhuapl.edu

Biography:
Ms. Bowman is a member of the Principal Professional Staff at the Johns Hopkins Applied Physics Laboratory (APL) in Laurel, Maryland. She is the Space Mission Operations Group supervisor and the NASA New Horizons Mission Operations Manager (MOM). She supervises approximately 50 staff members who operate deep space and Earth-orbiting spacecraft, including NASA's TIMED, STEREO, New Horizons, and Parker Solar Probe. As the New Horizons MOM, Ms. Bowman leads the team that controls the spacecraft that made a historic flyby of the Pluto system in July 2015. And on New Year's 2019, just after midnight, New Horizons made history again with a flight past the Kuiper Belt object Arrokoth – the most distant flyby ever conducted, 4 billion miles from Earth. Prior to operating spacecraft, she worked in the fields of computer modeling, drug research, and long-wave detector research.

Ms. Bowman has a degree in chemistry and physics from the University of Virginia and has more than 30 years of experience in space operations. She is an AIAA Associate Fellow and has served on the International SpaceOps Committee since 2009.

Abstract: "Mission to Pluto"
This presentation will give an overview of NASA's historic mission to Pluto and the Kuiper Belt– which culminated with the first flight past the distant dwarf planet on 14 July 2015 and the first encounter with a Kuiper Belt object (KBO) on 1 January 2019. This continuing journey will be discussed through the eyes of the APL mission operations team and some of the technical, scientific, and personal challenges of piloting the New Horizons spacecraft across the solar system on its voyage to the farthest reaches of the planetary frontier will be described.

JIM “JB” BROWN

Email: jamesebrown3@yahoo.com

Biography:
Jim Brown graduated “With Distinction” from the Virginia Military Institute in 1976 with a B.S. degree in Civil Engineering, earned a Master of Science in Management from Troy State University, and completed graduate study in Mechanical Engineering with California State University, Fresno. Following two European tours flying the F-4 and F-5 he was selected to attend the USAF Test Pilot School where he graduated with Class 86A in December 1986. Following graduation he tested the A-7, F-15 Eagle, F-117 and F-22. In 1994 he was hired by the Lockheed Skunk Works as an Experimental Test Pilot in the F-117 Stealth Fighter. While on the F-117, he tested software, avionics, and weapons improvements. Many of these improvements saw service in Operation Joint Endeavor over Bosnia and Operation Iraqi Freedom, the second Gulf War. As the Chief Test Pilot and after flying the Nighthawk for eight years with over 900 flight hours, he went on to test the F-22, eventually becoming the Raptor Chief Test Pilot. In January 2016 he retired from Lockheed Martin and joined the National Test Pilot School as the Chief Operations Officer and Test Pilot Instructor. Brown is a Fellow and Past President of the Society of Experimental Test Pilots, a Fellow of the Royal Aeronautical Society and an Eagle of the Flight Test Historical Foundation. He has logged over 9,600 flight hours in 152 different models of aircraft and is the world’s highest time Stealth Fighter pilot.

Abstract: “MiG-21 and MiG-23 Qualitative Evaluations”

The MiG-21 (NATO “Fishbed”) and MiG-23 (NATO “Flogger”) were the subject of much study and mystery amongst NATO pilots during the Cold War, with both aircraft being mainstays of the Soviet Bloc air fleet. However, any significant data regarding these aircraft was classified and not available for dissemination. Since dissolution of the Soviet Union, several of these aircraft made their way into the hands of aviation enthusiasts in the United States. As a result, limited unclassified flight test can be conducted and the results presented to the Society of Experimental Test Pilots.

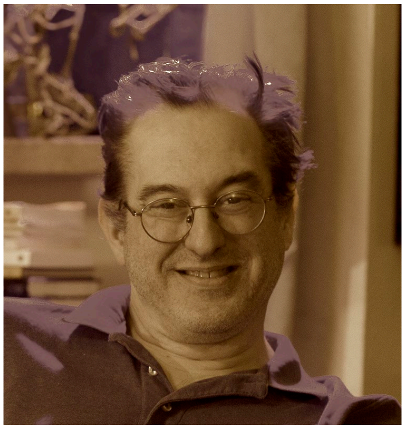
This presentation is an overview of both aircraft from experiences and data obtained during National Test Pilot School student projects in the two-seat MiG-21UM during a cross-country ferry and subsequent flight test. It also includes details of a two-seat MiG-23UB cross-country ferry and further testing. Topics will include a comparison of aircraft systems, design and operational philosophy between these Soviet workhorses, and what is typically found in Western fighter designs.

The MiG-21, of which over 10,000 were built, was known to be a small, agile second-generation fighter and point defense interceptor. It was thought to have a reasonable high angle-of-attack capability and resistance to departure from controlled flight. Flight test results will be presented to show the advantages and disadvantages of this design in those roles. Limited performance and flying qualities results will be included.

With over 5,800 MiG-23s having been delivered, this aircraft was viewed as a large improvement to the MiG-21. This third-generation, swing-wing fighter was thought to have improved combat radius over the Fishbed and was rumored to have quite nasty high angle-of-attack characteristics. Qualitative and some quantitative data will be provided to prove and refute these concepts.

Abstract: “Flying Lockheed’s Stealth Fighters”

This presentation is an outline of Lockheed’s stealth fighter development from a test pilot who has flown both F-117 and F-22. It starts with a basic overview of low observable theory to facilitate further aircraft-specific discussions. A brief history of the origins of stealth follows, which leads to the Stealth Fighter program and development of Have Blue and the F-117. The F-117 is discussed from a pilot’s viewpoint highlighting various features and characteristics of the aircraft. As a follow-on, the F-22 is discussed to show how stealth and other technologies were merged into the world’s most capable fighter aircraft. This briefing illustrates how stealth changes the very nature of aerial warfare and provides a significant force multiplier to the operational commanders. Unique features of each aircraft will be illustrated with the addition of trivial tidbits from a pilot’s viewpoint that audiences find interesting.



JIM CAVERA

Email: j_cavera@yahoo.com

Biography:
Mr. Cavera is a senior engineer with Blue Origin. He has undergraduate degrees in optical engineering and physics, and his graduate work was in nuclear engineering and aerospace engineering, during which he explored the use of dense plasma focus devices for interstellar travel. He has served for many years on AIAA's Nuclear and Future Flight Technical Committee and is currently its vice chair. His current research is in neutronics and MHD codes for fusion device simulation.

Abstract: “Future Propulsion: Nuclear Fission, Fusion, and Beyond”
Nuclear propulsion promises performance many orders of magnitude better than chemical propulsion. Chemical propulsion can give us the moon, but nuclear propulsion can give us the solar system and even the stars. In this talk, the theoretical underpinnings of nuclear propulsion, the historical experiments, and the prospects for the future will be discussed. At the discretion of the organizers, fission, fusion, or other future concepts can be focused on.

MICHELLE EVANS

Email: mach25@sbcglobal.net or x15gal@gmail.com

Biography:
Ms. Evans is the founder and president of Mach 25 Media (www.Mach25Media.com) and is a writer, photographer, and communications specialist in aerospace. She has written the book *The X-15 Rocket Plane, Flying the First Wings into Space,* published by the University of Nebraska Press in 2013 as part of their *Outward Odyssey, People's History of Spaceflight* series.

Ms. Evans' background in aerospace engineering includes serving in the U.S. Air Force working on missile systems, and later in private industry accomplishing environmental testing for systems used in airliners and spacecraft. In addition to her writing, Ms. Evans' current work with Mach 25 Media provides education and display services for astronaut appearances and other space-related events at government facilities, science centers, schools, and other venues across the country and overseas.

Abstract: "The X-15 Rocket Plane: Flying the First Wings into Space"
With the Soviet Union's launch of the first Sputnik satellite in 1957, the Cold War soared to new heights as Americans feared losing the race into space. This presentation tells the enthralling yet little-known story of the hypersonic X-15, the winged rocket ship that met this challenge and opened the way into human-controlled spaceflight.

This remarkable research aircraft held the world's altitude record for 41 years, and still has no equal to match or better its speed of more than 4,500 mph. Beyond the X-15 are the stories of the 12 men who guided it into space, and all the people who kept the rocket plane flying for nearly a decade. This is the story that has never been told of the vehicle that was the true precursor to the Space Shuttle by being the first piloted and winged vehicle to exit Earth's atmosphere, and make a controlled reentry to a landing on hard-packed dry desert lakebeds.

In her research, Ms. Evans interviewed nearly 70 people, including 9 of the 12 pilots, including Neil Armstrong, Scott Crossfield, and Robert White, with family representatives for the remaining pilots. Others she spoke with include managers, flight planners, and the technicians and engineers who made the X-15 ready to fly its next research mission at high altitude and high Mach.

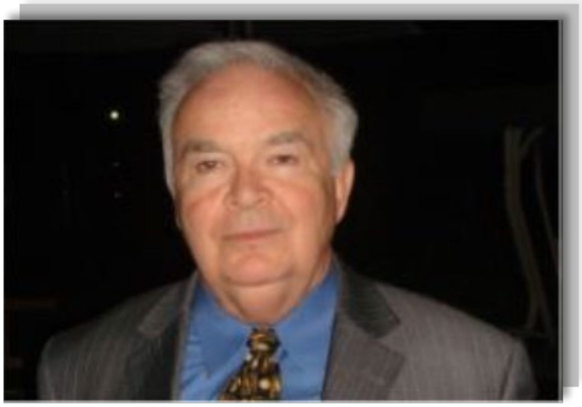
Abstract: "In the Line of Duty: Michael Adams and the X-15"
The X-15 rocket plane was America's premier research X-plane. It became the first aircraft to reach hypersonic velocities, and to create a new class of astronauts, ones who flew wings into space rather than rockets. The twelfth and final of these pilot/astronauts was Major Michael Adams from the U.S. Air Force.

As soon as the first group of American astronauts was announced in 1959, Adams knew where his career would take him. He was twice forestalled in his attempts to reach space. First by losing a slot in the second group of American astronauts because of injuries sustained in an F-104 ejection, then by being chosen for the Air Force's Manned Orbiting Laboratory, which was canceled when politics entered the fray.

Adams saw the X-15 as his new pathway to space, and was quickly accepted into that elite group, which included such legendary test pilots as Scott Crossfield, Robert White, and Neil Armstrong. Mike Adams was the only X-15 pilot to lose his life while flying the program. Because of this, few people

know of him today.

Michelle Evans' research for her book, *The X-15 Rocket Plane, Flying the First Wings into Space* led her to interview nearly 70 people connected to the program, including Adams' wife, children, brother, and friends. Her unique perspective has been able to honor Major Michael J. Adams, and to bring him to life as one of the X-15 astronauts in her fascinating presentation.



EUGENE L. FLEEMAN

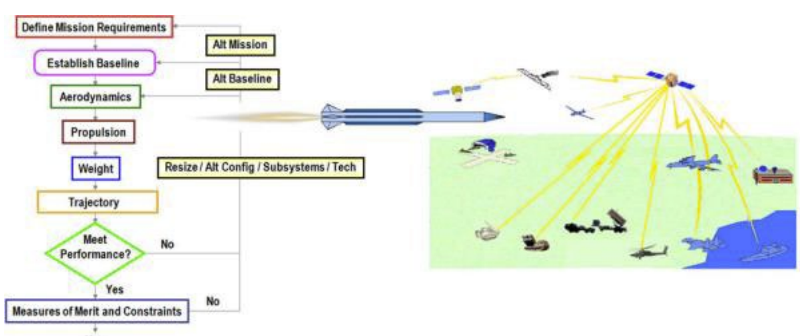
E-mail: GeneFleeman@msn.com
Website:
https://sites.google.com/site/eugenefleeman/home

Biography: Mr. Fleeman has 50+ years of government, industry, academia, and consulting experience in the design and development of missile systems. Formerly a manager of missile programs at the Air Force Research Laboratory, Rockwell International, Boeing, and Georgia Tech, he is an international lecturer on missiles and the author of 200+ references, including the AIAA textbook *Missile Design and System Engineering*. He is an AIAA Associate Fellow, an AIAA Distinguished Lecturer, and a former chair of the AIAA Missile Systems Technical Committee.

Abstract: "Missile Design, Development, and System Engineering"

This lecture presents the fundamentals of missile design, development, and system engineering. It is oriented toward AIAA luncheon and dinner meetings. It addresses the broad range of alternatives in satisfying missile cost, performance, and risk requirements. The methods presented are generally simple closed-form analytical expressions that are physics-based, to provide insight into the primary driving parameters. Typical values of missile parameters and the characteristics of current operational missiles are discussed, as well as the enabling subsystems and technologies for missiles and the current/projected state of the art. Videos illustrate missile development activities and performance.

Abstract: "Key Drivers in the Missile Design, Development, and System Engineering Process"



This lecture identifies the key drivers for the process of missile design, development, and system engineering. It is oriented toward AIAA luncheon and dinner meetings. Key drivers presented for the missile design process include the skills of the design team, system requirements flow-down, alternative approaches, subsystems and technologies selection, flight trajectory modeling and launch platform integration. Key drivers for the missile development process include technology and system development, simulation, ground tests, flight tests, and

upgrades. Key drivers for the missile system engineering process include system-of-systems integration, launch platform integration, safety, and environmental integration. Videos illustrate the missile design, development, and system engineering process.

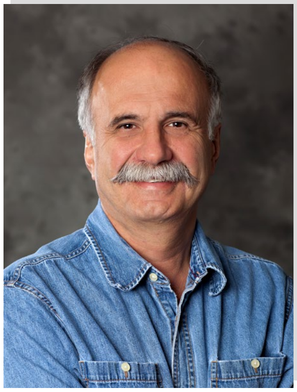
Abstract: "My Career in Aerospace Engineering and a Soda Straw Rocket Science Design, Build, and Fly Competition"

This two-part lecture consists of a summary of my career in aerospace engineering, followed by a soda straw rocket design, build, and fly competition. It is oriented toward AIAA student branches and AIAA STEM outreach.

The lecture begins with examples of my 50+ years of work experience as a government aerospace engineer, industry aerospace program manager, university teacher of aerospace engineering, author of aerospace engineering textbooks, short course instructor in aerospace engineering, and STEM educator in aerospace engineering.

The Soda Straw Rocket Science Design, Build, and Flight Competition is an aerospace engineering project to demonstrate the physics of flight using small air rockets. Each attendee will design, build, and fly a small air-powered rocket. The DBF competition provides an appreciation of the impact of design parameters such as weight, length, center-of-gravity, nose geometry, surface geometry, chamber pressure, and launch angle on the flight range and dispersal. Students are introduced to the physics of thrust, total impulse, boost velocity, drag, flight stability, and flight trajectory. These can be predicted with the physics-based methods of the AIAA textbook *Missile Design and System Engineering*.

The lecture requires about 60-to-90 minutes of time, depending upon the size of the class.



MIKE GRUNTMAN

Email: mikeg@usc.edu
Website: astronauticsnow.com

Biography:

Dr. Gruntman is professor and chair of astronautics at the University of Southern California (USC). His life journey took him from a child growing on the Tyuratam (Baikonur) missile and space launch base during the late 1950s and early 1960s to an accomplished space physicist and engineer to joining USC in 1990 and founding a major educational program in space engineering. Today it is a nationally recognized unique astronautical engineering department at USC.

Dr. Gruntman is actively involved in R&D programs in space science and space technology. He served as a co-investigator (Co-I) on NASA missions and is a recipient of three NASA Group Achievement Awards. He has authored and co-authored 300 scholarly publications, including four books. His *Blazing the Trail: The Early History of Spacecraft and Rocketry* (AIAA, 2004) won the International Academy of Astronautics book award. More than two thousand graduate students have taken Dr. Gruntman's courses in space systems and rocket propulsion at USC. He also teaches short courses (AIAA and ATI) for government and industry.

Dr. Gruntman is an AIAA Associate Fellow and Member (Academician) of the International Academy of Astronautics.

Abstract: "The Road to Space: The First Thousand Years"
This 70-80 minute lecture presents the fascinating history of early rocketry and subsequent developments that led to the space age. It introduces visionaries, scientists, engineers, and political and military leaders from various lands who contributed to this endeavor. The development of rocketry and spaceflight is traced from ancient times through many centuries to the breakthrough to space. The story concludes with the launches of first artificial satellites in the late 1950s. Based on an award-winning AIAA-published book.

Abstract: "Intercept 1961: From Air Defense SA-1 to the Birth of Soviet Missile Defense"
This 70-80 min lecture focuses on Soviet strategic missile defense. On 4 March 1961, a guided missile intercepted and destroyed the approaching warhead of an intermediate range ballistic missile (IRBM) SS-4 at the Saryshagan test site in the Kazakhstan desert. This event led to the emergence of a powerful political, military, scientific-technological, and industrial missile defense complex in the Soviet Union, a major factor in shaping U.S. defense programs and technologies during the Cold War. A new chapter in the eternal competition between protecting and avenging, between the sword and the shield, has begun. The lecture tells a little-known story, based on an AIAA-published book, of the first Soviet antiaircraft system SA-1 and the first intercept of an IRBM, leading to the birth of Soviet missile defense and deployment of the first operational missile defense system A-35.

RICHARD P. HALLION

Email: DrHypersonic@aol.com, copy to ChrisHallion@aol.com

Dr. Hallion received a B.A. in 1970 and a Ph.D in 1975, both from University of Maryland. He also graduated from the National Security Studies Program for Senior Executives, Kennedy School of Government, Harvard University, 1993.

He was the Curator of Science and Technology, National Air and Space Museum, 1974-1980; the NASA Contract Historian, and Adjunct Faculty at the University of Maryland, 1980-1982; the Air Force Historian at Edwards AFB, Wright-Patterson AFB, Andrews AFB, and the Pentagon, 1982-2004; the Senior Advisor for Air and Space Issues, Office of the Secretary of the Air Force 2004-2006; the Special Advisor for Aerospace Technology to the Air Force Chief Scientist, 2006-2008; the Senior Advisor, Commonwealth Research Institute/Concurrent Technologies Corporation, 2007-2012; Senior Consultant to the Science and Technology Policy Institute of the Institute for Defense Analyses; Vice President, Earth Shine Institute, 2009-present; and a Research Associate in Aeronautics, National Air and Space Museum, Smithsonian Institution, 2010-present.

Dr. Hallion is the author of 13 books; 12 monographs and special studies; 31 chapters; numerous articles, essays, and presentations; and the editor of 6 books. He is a Fellow of AIAA, RAes, and the Royal Historical Society; and a member of the Air Force Association; the Association of Naval Aviation; the United States Naval Institute; the International Test and Evaluation Association, the National Defense Industrial Association; the Royal United Services Institute for Defence Studies; the American Aviation Historical Society; and the Society for the History of Technology.

Abstract: “The High-Speed Revolution: How Aviation Progressed from the Subsonic to the Hypersonic Era”
This lecture traces the evolution of aerospace technology from the high-performance subsonic propeller-driven monoplane through the invention of the jet engine, the aerodynamic and propulsion challenges of transonic flight, the role of flight testing and flight research, and the international progression of aviation into the supersonic and hypersonic era, drawing on case studies of various international programs and presenting lessons learned from this history.

Abstract: “A Century of Military Aviation”
The airplane, like the submarine, introduced three-dimensionality to warfare, dramatically transforming the nature of combat across the spectrum of conflict from low-intensity to high-intensity war. This talk examines the key aspects of military air power evolution, its impact upon strategy and combat operations, and the implications of contemporary developments in military aerospace capabilities to the future of conflict.

Abstract: “Naval Aviation: The First Hundred Years”
1911 marked the 100th anniversary of naval aviation. This talk examines how the Navy adapted to the airplane, how aircraft influenced the naval campaigns of the First and Second World Wars, and how naval aviation functioned throughout the Cold War and post-Cold War era. Specific technical developments of both ships and aircraft are evaluated and their impact upon combat operations is presented. Lessons learned from the first century of naval aviation are enumerated, and its current status is examined.

Abstract: “Global Aviation in the Interwar Era”
The years between the First and Second World War constitute what is commonly called the “Golden Age” of aviation, but they were, as well, a time when dramatic changes took place in the international balance of air power, aviation development, and the employment of aviation for civil and military purposes. This talk traces the development of aviation over that time period, the role of governmental and private support for aeronautical research and development, and the growth of commercial aviation and military air power.

Abstract: “Air Power in the First World War”
2014 marks the 100th anniversary of the “War to End All Wars,” which marked the first mass use of aircraft and airships in air warfare. Often seen as irrelevant to the war’s larger outcome, air power in the “Great War” actually had a surprisingly influential effect on both land and maritime operations. The roles and missions of modern air power were first enunciated and promulgated in the First World War, as were basic concepts of doctrine and

command and control. This talk examines how air power evolved from the time of the first military aircraft in 1908 through the Armistice in 1918, and the implications of that experience to what happened afterwards—and today and the future as well.

Abstract: “Air Power in the Second World War”
The Second World War marked the maturation of air power and three-dimensional attack from both the air and from beneath the sea. From the *Blitzkrieg* in 1939 through the dropping of the atomic bomb in 1945, air power played a central role in the strategy and conduct of combat operations. This talk examines the global air war, the key events that shaped the war’s outcome, and the impact of aeronautical and propulsion technology, and the respective national industries, upon the shaping and employment of military air forces.

Abstract: “The History of Hypersonics”
The advent of supersonic flight opened the path to the hypersonic frontier, first crossed by rockets and missiles and then by uninhabited and piloted winged vehicles and spacecraft. This talk examines how hypersonic flight evolved from a dream of the great pioneers of astronautics to a practical field of technical inquiry. Key programs and technical developments in aerodynamics, structures, propulsion, and controls are examined together with lessons learned and an assessment of the current state and future prospects of this exciting field.

Abstract: “Air Dominance: The Enduring Requirement”
Since the advent of the military airplane, seizing and controlling the air has been of crucial importance. With control of the air, all other missions are possible; without control of the air, all other missions are compromised and endangered. This talk examines the evolution of air dominance warfare, including the history of fighter aircraft development, defensive and offensive fighter strategy and tactics, the evolution of ground-based air defense threats (particularly surface-to-air missiles), and examines the current challenge of waging effective air operations in the emerging era of 5th Generation and Double-Digit SAMs. Combat experience and lessons learned are presented from a variety of conflicts and crises in which air dominance proved of crucial importance, or crucially lacking.

Abstract: “China's Rise as an Aerospace Nation”
The rise of China as a major regional air and space power has been one of global aerospace's most significant developments over the last two decades. This talk traces the development of aeronautics and astronautics in China from antiquity to the present, showing the role of both indigenous Chinese development, foreign influences, and the political-military-commercial environment that has shaped China's choices and ability to pursue its own air and space future.

Abstract: “Aviation’s Impact and Development During the First World War”
The invention of the military airplane in 1908-1909 was not immediately regarded as a significant event, yet the opening months of the First World War saw the frail aircraft and adventurous airmen of that early era transform military operations and, indeed, the subsequent course of the war. The technological development of aviation between 1914-1918 was profound: at the beginning of the war, aircraft were hardly more powerful than modern ultralights. At war’s end, airplanes (and airships) existed that would span the Atlantic in 1919 and fly as far as Australia and South Africa. This lecture traces both the military and technological evolution of aviation and air power over the period of the “Great War,” and shows why it is relevant to us today, a century later.

Abstract: “Rolling Thunder Fifty Years On: The Genesis, Evolution, and Impact of America’s Most Controversial Air Campaign”
In 1965, President Lyndon Johnson, Defense Secretary Robert McNamara, and Joint Chiefs Chairman Earle Wheeler launched Operation Rolling Thunder (1965-1968), an ill-considered effort to persuade the leadership of then-North Vietnam to abandon their support of Viet Cong guerrillas in South Vietnam, and Pathet Lao insurgents in Laos. Initiated at a time when Johnson and others had at best ambivalent views over the emerging war in Southeast Asia, Rolling Thunder proved a costly failure, marked by high losses of aircrew and airplanes, with many of those who survived enduring years of brutal captivity before release in 1973. Rolling Thunder has become the “how not to” air campaign of the “how not to” war, but its influence—on strategy, operational planning, training, tactics, procedures, and technological development was profound, and continues to influence military operations and thought today.

TUCKER "CINCO" HAMILTON

Email: tuckerhamilton@hotmail.com

Biography:
Hamilton is an Experimental Fighter Test Pilot by trade and currently works at MIT in the field of artificial intelligence. Hamilton started his career as an operational F-15C pilot. He supported multiple Red Flag Exercises and real-world Operation Noble Eagle missions where he protected the President of the United States, at times escorting Air Force One. He served as an Air Liaison Officer in Germany where he was the director of operations for a key command and control squadron. While serving in Germany he was hand-selected to be the initial cadre for the first MC-12 squadron in Afghanistan, heralding in one of the first tactical Intelligence, Surveillance, and Reconnaissance aircraft. He served as the Chief Instructor for 200+ aircrew and accumulated over 400 combat hours directly supporting ground forces.

After his time in the MC-12 he attended Test Pilot School (TPS) where he flew 30 different aircraft and took part in the first Automatic Air Collision Avoidance System testing. After TPS graduation he became an F-15C and F-15E Instructor Experimental Test Pilot. He was the lead test pilot on 11 test programs; supporting the newest software, systems, and weapons for the 450+ F-15 fleet. He then served near the Pentagon as a Program Manager for the Joint Strike Fighter, F-35, overseeing the entire flight test effort for the U.S. Air Force, Navy, and Marines. He managed an 18 test-aircraft fleet of specially equipped F-35s across multiple operating locations with a $3B budget. After his program manager assignment he took command of the 1,000 person unit that executed F-35 flight test. Hamilton has more than 2,000 flying hours in the F-35A/B/C, F-15C/D/E, F-18, F-16, A-10, T-38A/C, T-34, T-6, and 20 additional aircraft. He currently lives in Cambridge, MA, with his wife and four children.

Hamilton is the recipient of the National Aeronautics Association Collier Trophy Recipient, 2019; the Society of Experimental Test Pilots Annual Herman Salmon Award, 2017; the USAF STEM Contributor of the Year, 2016; Ten Outstanding Young American Award, 2015; USAF ISR Officer Contributor of the Year, 2010; and the University of Colorado Thomas Jefferson Award, 2002.

Abstract: "Making a Difference at Mach 2"
Through pictures and videos Hamilton shares what it takes and what it is like to be an Experimental Fighter Test Pilot. Personal stories include major life-threatening aircraft accidents, close saves, combat flying revelations, serendipitous opportunities testing first of its kind technology, flying over 30 aircraft from a zeppelin to a MiG-15 to an A-10, and managing the Joint Strike Fighter Developmental Test program for all three services. Through these experiences you will learn not just what a Test Pilot does, but also gain encouragement through lessons learned on how to make a difference in your local communities—and cool flight test videos are included!

Abstract: "F-35 Flight Test"
What's the F-35 really fly like? Does it have the capability to be the preeminent fighter of the 21st century? How has F-35 flight test progressed and tackled challenges? Through personal experiences,

photos, and videos Hamilton will answer these questions and discuss 21st-century military airpower, the use of military aircraft technology/autonomy, and lessons learned from the largest aircraft acquisition program in the history of the Department of Defense**.**

Abstract: "Automatic Air Collision Avoidance System Testing"
The Automatic Air Collision Avoidance System (Auto ACAS) is a technology under development by the Air Force Research Laboratory in partnership with Lockheed Martin. Auto ACAS provides last resort air-to-air collision protection during air combat training operations by automatically maneuvering aircraft away from each other while minimizing interference with pilot operations. The Auto ACAS software was integrated onto an existing, commonly used Air Combat Maneuvering Instrumentation (ACMI) pod that is currently carried by many U.S. and foreign fighter aircraft.

With current fiscal constraints this type of high-risk/high-cost testing is nearly impossible to execute. However, through use of the United States Air Force Test Pilot School (TPS) Test Management Program (TMP) along with novel usage of the NF-16D VISTA aircraft this program was initialized as a low-risk/low-cost test program. Savings were on the order of hundreds of millions of dollars. TPS students took the program through three vitally important steps: 1) ACMI pod reliability, 2) Avoidance maneuver acceptability, and 3) Initial algorithm integration during two-ship operations.

This presentation is an overview of the initial and current flight test program as well as the unique flight test methods that were used to successfully execute automatic avoidance maneuvers. Additionally, lessons learned from test planning, safety planning, and test execution will be presented with an emphasis on test point buildup, utilization of low-cost TPS support, and end-game benefits of the specific workarounds implemented to deal with a fiscally constrained environment.

Abstract: "Break the Store, Not the Airframe: CFP Testing in a 30-Year-Old Envelope"
Compatibility Flight Profiles aim to ensure a test store has the structural integrity to withstand the airframe envelope while not negatively affecting flying qualities. Test programs are rightly concerned about mitigating safety risk through focused test point selection and classic test principles – such as the build-up approach. However, what if the real issue is not the store but the actual airframe itself! Limited exposure to the corners of the flight envelope coupled with 30 years of structural wear make the airframes themselves a safety risk. While accidents have made this issue evident the test community has failed to address the real factor of testing airframes and stores at the corners of the envelope. An overview of CFP lessons learned will be presented in the hope of addressing a way forward for 4th generation fighter CFP testing and ways to mitigate future testing of 5th generation CFP.

Abstract: "F-15E TRIDENT Missile Surrogate Tests"
For 15 years, the 40 FLTS has helped sustain the U.S. Nuclear Triad through tests in support of the TRIDENT missile program. This testing is accomplished with a TRIDENT guidance pod carried on the F-15E. Test pilots emulate the entire missile profile including the launch and boost phase, the ballistic phase, and the re-entry phase. The methods of simulating each missile phase include high-g wind-up-turns, steady-g horizontal turns, dynamic aerobatics, and steady heading side-slips. The maneuvers require strict adherence to multiple parameters. The critical lesson learned from this program is the advantages gained by using surrogates to test unique systems. For this particular program it has saved millions of dollars as well as provided a platform to test future submarine requirements – not bad for a simple pod on a wing. An overview of the program, flight profiles and lessons learned will be presented to benefit and encourage similar testing.

Abstract: "First-Ever Missile Shot at 1.2M/7Gs…What Could Go Wrong!?"
The objective was to take a missile that had never flown on the F-15, integrate it, complete a compatibility flight profile mission to ensure store integrity, and then fire it at 1.2 Mach, 7 Gs, 2 miles behind a full-scale F-4 drone. It was never the intent of the test team to go after such an aggressive first shot, but after careful deliberation with the engineers it was decided the risk was acceptable. The actual timing, technique, and execution of the missile shot was the real challenge, coupled with the requirement for a photo chase to capture the launch 500 feet off the wing. Though a traditional buildup approach was not possible due to constraints, the test team had to mitigate risk through rigorous preparation and practice. Risk mitigation through mission planning along with execution lessons learned, like how the first attempt was a hang fire, will be presented.

JIM HORKOVICH

E-mail: JHorko1948@gmail.com

Biography:

Dr. James A. Horkovich is an expert in Directed Energy Systems. Upon his graduation from the Rensselaer Polytechnic Institute in Troy, New York with Bachelors & Masters degrees in Aeronautical Engineering, he went into the United States Air Force as a Commissioned Officer. During a 20+ year career in the Air Force, he served as a warfighter performing testing and engineering services to tactical and strategic aircraft and weapons systems, taught cadets as a professor of aeronautical engineering at the United States Air Force Academy, and then served as a prime architect for the nation's high-energy space-based and airborne laser systems as a part of the Strategic Defense Initiative Organization. While on active duty, he earned his doctorate in aerospace systems at the Air Force Institute of Technology at Wright-Patterson Air Force Base in Dayton, Ohio. His Doctoral dissertation demonstrated the first adverse pressure gradient capable Navier-Stokes codes for the design of the Airborne Laser Pressure Recovery System; indeed, this body of work remains a technical source in this arena. He retired from the US Air Force in 1990 with the rank of Lt. Colonel (O-5), having been decorated with the Air Force Commendation Medal and its Meritorious Service Medal.

After his military service, from 1990 to 2004, Dr. Horkovich worked on technology advances, first at Shafer Corporation in high-energy lasers for multidisciplinary systems that involved directed energy, electro-optics, power electronics, and thermal management, and, then as a Senior Scientist at SAIC (Science Applications International Corporation). From 2004 to 2015, James Horkovich joined Raytheon Corporation as an Engineering Fellow, serving as the chief engineer for its collaborative weapons projects in the advanced missiles and unmanned systems product lines of the company's Missile Systems Engineering organization. There he directed near-term laser technologies, enabling the first practical fiber-laser capabilities, including his role as the master systems architect for Raytheon's tactical laser concept called LaWS (Laser Weapon system). In 2015, he rejoined Shafer Corporation as its Director for Directed Energy Programs. In 2018, he affiliated as a Senior Principal Scientist with Aegis Technologies, now part of the BlueHalo Technologies universe.

Jim has been an active member of the AIAA throughout his 50 year career. He was elected as an AIAA Fellow in 2012, received the AIAA Sustained Service Award in 2013 and the Plasmadynamics and Lasers Technical Award in 2019. From his briefings to then British Prime Minister Margaret Thatcher to U.S. Congressional Testimonies, & up to the White House Office of Science & Technology, his technical expertise continues to provide critical inputs to R&D developments and decision makers. In addition, he is the President Emeritus of the Board of Directors of the Directed Energy Professional Society (DEPS) and is spokesperson and industry lead for the Directed Energy Outreach Program. He was inducted as a Fellow of DEPS in February 2017.

Abstract: "Directed Energy Weapons; Promise & Reality (Myths, Legends, and Facts: Reflections of a 'Star Warrior')"

This talk presents a history of missile defense and the "Star Wars" program and the fundamental physics and engineering of laser weapon systems. 2013 marked the 30th anniversary of President Ronald Reagan's "Star Wars" speech. Since Archimedes' "Burning Glass" at the siege of Syracuse 212 B.C. through the development of the LASER, man has been fascinated with the idea of using directed energy weapons. But nothing has done more to focus this effort than the threat posed by Mutually Assured Destruction. Under Reagan's "Star Wars" plan, years and billions of dollars were invested in making high-energy laser systems a reality. This presentation traces the development of these systems from the Gas Dynamic LASER laboratory in the 1960s and the USAF Airborne Laser Laboratory of 1981 through to the latest UAV systems and Non-Lethal Area Denial systems of today. In reflecting on the effort invested in developing this technology, this talk addresses the critical role that these programs played in ending the cold war and continue to play in securing our national defense.

GREG MEHOLIC

Email: orionstar2209@yahoo.com or greg.meholic@aero.org

Biography:

Mr. Meholic currently works as a senior project engineer for The Aerospace Corporation supporting space launch vehicle concept development and advanced propulsion system technology for the U.S. government. Prior to his current position, he supported upper-stage cryogenic rocket engine launch activities, performance reviews, and hardware design assessments for most of the U.S. space launch systems, contributing to over four dozen successful missions. His work also included defining launch vehicle operational requirements, launch systems and designs, and leading numerous project teams for both NASA and DARPA-funded studies regarding the capabilities and testing of advanced engines.

Mr. Meholic earned both his undergraduate and graduate degrees in aerospace engineering from Embry-Riddle Aeronautical University. He first worked at General Electric Aircraft Engines in gas turbine performance and preliminary design, component life analysis, mechanical design and advanced concept development. His work in pulse detonation engine (PDE) technology allowed him to obtain four patents on PDE valve concepts and applications. He also gained extensive experience with engine servicing, component production and testing. While at GEAE, Greg also began teaching within the company and eventually developed several classes for new employees on product familiarization. That interest has continued, and he now is an adjunct professor at Loyola-Marymount University teaching a course in Propulsion Systems for aircraft and spacecraft.

Although Mr. Meholic focused his graduate studies on propulsion systems and aerodynamics, he has always been fascinated by the possibility of faster-than-light (FTL) space travel. Ever since his early college days, he has developed many theories of his own that have evolved into a unique model of space-time and the universe bordering on a grand unified theory. Out of these ideas came a new proposal for the definition of gravity and inertia, possible applications of string theory, a suggested source of dark matter and the Trans-Space method of FTL travel, which is different from the traditional "warp drive" that has garnered public familiarity and science-fiction fame. Since 1998, he has published several papers on his work.

Greg is an AIAA Associate Fellow and is the current chair of the AIAA Nuclear and Future Flight Propulsion Technical Committee. He is the session organizer for that committee for the AIAA Propulsion and Energy Forums and also chairs related sessions at other technical venues.

Greg is an instrument-rated private pilot and has flown all over the country in his Cessna 172. He and his wife are extremely active with their toddler son and can be found roller-blading, bicycling or hiking in the Los Angeles area.

Abstract: "Advanced Space Propulsion Concepts for Interstellar Travel"

The presentation begins by examining just a few of the compelling reasons why humans should explore the heavens beyond the bounds of the solar system. Certain terms and issues are defined to clarify the requirements of such daunting journeys. The talk then centers around the key technology required to make such missions possible—propulsion. To start with, a brief discussion is given on the state of the art of in-space chemical propulsion systems to develop a foundation of where engine

technology is today. The talk then takes an evolutionary approach by exploring some of the more advanced engine systems intended for long-range solar system exploration, such as nuclear engines, antimatter engines, and interstellar ramjets, which define the capability limits of chemical propulsion. After comparing the predicted performance of these advanced concepts to the requirements for interstellar journeys, the focus will then shift to describe a new paradigm of “propellantless” propulsion schemes that have their basis in modern theoretical physics and cosmology. If found attainable, concepts such as space-time manipulation, faster-than-light travel, wormholes, quantum drives, and so on, may provide the only viable propulsion options to enable reasonable trip times to distant stars. To show that these ideas are not merely the dreams of science fiction, brief descriptions will be given on the latest, global, experimental efforts to explore the fundamentals behind some of these intriguing concepts. The talk will end with some inspiring conclusions and hopefully instill the belief that mankind will someday move beyond the bounds of our solar neighborhood.

NAHUM MELAMED

Email: nahum.melamed@aero.org

Biography:
Dr. Melamed is a project leader in the Embedded Control Systems Department in the Guidance and Control Subdivision at The Aerospace Corporation. He joined Aerospace in 2003. As a technical lead in Launch Vehicle Software, Melamed coordinates and guides a team of interdepartmental technical experts, and supports validation and mission readiness certification of the flight software and mission parameters for the Delta IV launch vehicles. He conducts planetary defense technical and policy studies, serves on planetary defense conferences, exercises organizing committees, and speaks at these venues. He earned a Ph.D. in Aerospace Engineering from Georgia Tech.

Abstract: “Planetary Defense from Asteroids and Comets”
Near-Earth objects (NEOs) are asteroids and comets that pose a local, regional or continental threat. The realization that asteroid impacts are a modern-day possibility followed analyses that proved many of the craters on Earth were caused by cosmic impacts rather than by gradual geological process or volcanic eruptions. In the 1980s researchers discovered that the demise of the dinosaurs some 65 million years ago coincided with a major asteroid impact, and in 1994 observers recognized similar-sized impacts when fragments of comet Shoemaker-Levy 9 smashed into Jupiter. If such an object were to hit Earth today, it could cause widespread devastation and profoundly affect life on Earth. Although major cosmic collisions with Earth are infrequent, their consequences could be severe. Hence, advanced planning is critical to mitigating future asteroid threats. And the best time to start preparing is now—well before any actual threat is detected.

Given this reality: What are the current risks? How would we deflect an asteroid or comet on a collision course with Earth? What are the technical and political risks? What are the obligations and strategic interests that would drive a decision to act? This talk describes results and answers to these questions gained from recent international planetary defense conferences and table-top exercises that examined threat responses, and from the latest scientific studies. The talk also highlights evolving public and educational outreach, new simulation tools, recent space missions, and actions at the United Nations that support planetary defense.

Asteroid Deflection Class – Hands-on
NEOs, or Near-Earth Objects, are asteroids and comets that can collide with and damage the Earth. To understand how an approaching NEO can be deflected off the Earth while still in deep space, a physics-based NEO deflection app, or NDA, was developed jointly by The Aerospace Corporation and NASA JPL (https://cneos.jpl.nasa.gov/nda/). The talk describes a planetary defense class developed by Aerospace that applies the app in hands-on exercises. The app is used to identify feasible launch windows and design NEO deflection missions by high-energy kinetic impact of spacecraft with the NEO, and by nuclear standoff detonation.

The course introduces the nature of the NEO threat and covers recent impact events, discovery, tracking, and characterization efforts. The course also provides insights on NEO threat mitigation concepts and options and identifies gaps and challenges in our mitigation capability. Students select a NEO from a set of simulated objects created by JPL, identify feasible launch windows, apply an iterative process to find feasible deflection solutions, and design a deflection mission or campaign. Teams can form and compete to achieve the highest deflection performance with the least resources. The class appeals to specialists as well as to the general audience and does not require any programming skills.

Abstract: “Applying GN&C Solutions to the Problem of Asteroid Interception for Planetary Defense”
The impact consequences of Near-Earth objects (NEO) require proactive measures to eliminate or reduce them when lead times are too short for effective deep space Deflection/destruction. To expand mitigation beyond deep space, ground-based pre-built interceptors launched minutes before atmospheric entry can respond to detection times from minutes to months. The disruption of a small NEO prior to its atmospheric

entry could potentially eliminate or reduce damage to the ground by dispersing its kinetic energy over a wider area.
The Guidance and Control Subdivision at The Aerospace Corporation has applied interceptor techniques to engage an incoming NEO at high altitude minutes before its atmospheric entry. Objective is to disrupt the object and deposit its kinetic energy at a higher altitude and disperse it over a wider footprint on the ground. A Monte Carlo simulation applied fireballs statistical property on NASA's database to correlate flight time and altitude of intercept with interceptor requirements. Preliminary results show that Exoatmospheric intercept altitudes are attainable even when detection and launch occur minutes before impact. Local, regional or national objectives determine the number of systems and response time requirements. Hydrocode modeling demonstrated the amount of disruption caused to the asteroid by several kinetic kill vehicles. Detection technology, terminal guidance capability, disruption analysis and debris reentry analysis are key areas of future work.

Abstract: "Intercept and Engagement of the PDC 2019 Comet with Solar Sailcraft"
Planetary defense for comets has not been given much attention to date because their estimated collision frequency with Earth is two orders of magnitude less than that for asteroids. However, a comet entering the inner Solar System is generally larger and faster than an asteroid and has greater potential for damage. Moreover, since comets originate from the outer regions of the Solar System, they are discovered late, perhaps only one or two years before their potential impact, and they can approach the Earth on highly inclined orbits with respect to the ecliptic plane. Accordingly, assessments made at recent Planetary Defense Conferences (PDC) place the threat from comets on a par with the threat from asteroids because their lower frequency is overtaken by their greater potential for damage.

To help understand possibilities and limitations in addressing the comet threat, NASA's Jet Propulsion Laboratory (JPL) has constructed a fictitious comet threat that puts a comet on a collision course with the Earth. This new threat has been added to those available on the NEO Deflection App (NDA, https://cneos.jpl. https://cneos.jpl.nasa.gov/nda/ nasa.gov/nda/) developed jointly by The Aerospace Corporation and JPL. Chemical rockets are incapable of intercepting near Earth objects approaching Earth from such high declinations with respect to the Ecliptic Plane until a few weeks before impact. Aerospace has shown that the EXCALIBRS (Expeditionary Comet/Asteroid Lander Interceptor BDA and Reconnaissance Sail) solar sail concept can intercept the comet three to six months before impact when it is still 1-2 AU from the comet-Earth encounter point.

KENNETH J. SZALAI

Email: kenszalai@aol.com

Biography:

Kenneth J. Szalai leads a technical and management consulting company with work in the areas of aeronautics and space technology, and commercial space. Prior to his consulting business, Szalai served as President of IBP Aerospace Group, Inc., in the development of advanced ejection seat technology. He was the Director of the NASA Neil Armstrong Flight Research Center (then NASA Dryden) at Edwards AFB, CA, from 1990 to 1998. Prior to this Szalai served NASA as a research engineer for 15 years and then held positions Chief of Dynamics and Control and Director of Engineering.

He served in various technical and management positions on dozens of NASA and joint NASA-military experimental flight research programs, X-airplanes, and international programs, including the joint U.S.-Russian Tu-144 high-speed flight research program. Szalai is a specialist in digital flight controls and flight research/test. He was the Chief Engineer on the F-8DFBW program, the first digital fly-by-wire aircraft. These programs explored advanced aerodynamics, propulsion, flight controls, structural dynamics, UAVs, solar-powered aircraft, and new configurations.

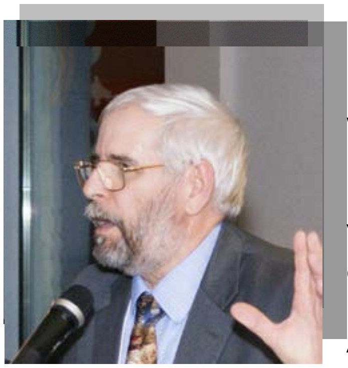
Szalai has authored over 25 papers and reports and has been a lecturer for the NATO Advisory Group for Aeronautical Research and Development. He has served on various technical committees for AIAA and SAE. Szalai graduated from the University of Wisconsin with a B.S. degree in electrical engineering and received a M.S. in Mechanical Engineering (Aeronautics) from the University of Southern California. He was awarded NASA's Exceptional Service Medal, Outstanding Leadership Medal, Distinguished Service Medal, and both the Meritorious and Distinguished Presidential Rank Awards. He is an AIAA Fellow and was awarded the 2000 AIAA Wright Brothers Lectureship. In 2003, he was one of the recipients of the ICAS von Kármán Award for International Cooperation for his work on the U.S.-German X-31 experimental aircraft program.

Abstract: "Flights of Discovery – Impact and Lessons from Experimental Flight Research at NASA Neil Armstrong Flight Research Center"

Significant high-risk and advanced experimental flight research programs are described in pictures and videos along with the discoveries that sprang from "expanding the envelope." Flight programs that paved the way for human spaceflight are also shown. These experimental flight projects made breakthroughs and provided a foundation for today's aircraft.

Szalai provides a unique view of NASA experimental, flight research. Major results and lessons learned are drawn from flight exploration at the frontiers of knowledge. Videos of flights at and beyond controllable boundaries for the F-8 Digital Fly-by-Wire, X-29 Forward Swept Wing, F-18 High Angle of Attack, and X-31 Highly Maneuverable Aircraft. Experimental flight research provides valuable and unmatched insight into the wonders and mysteries of flight. Little known Armstrong Flight Research Center problem-solving for the moon landing and space shuttle orbiter are revealed. The factors that led to the loss of an experimental aircraft are also explained.

Szalai Flight Program Experience



CHARLES T. “CHARLIE” VONO

Email: charlesvono@comcast.net
Website: charlesvono.com

Biography

Vono, an AIAA Associate Fellow, is a retired USAF colonel and retired defense contractor senior manager. In his 45-year career, he has been an operator, e.g., KC-135 aircraft commander. He has been an engineer, e.g., F-16 structures. And he has been a sustainer, e.g., ICBMs. He has a Bachelor of Science from the USAF Academy in Astronautical Engineering, a Master of Science in Systems Management from the University of Southern California, and a Master of Science in Mechanical Engineering from Utah State University. He is a graduate of Air War College. Vono has 13 years full-time active duty in Air Force and Joint assignments and 12 years part-time duty in Air Force Reserve assignments. Since retiring from a major defense contractor in 2014, Vono has been writing and presenting extensively on the sustainment of complex systems, but his most popular presentation harks back to his first USAF assignment in 1977 as a tanker pilot supporting the worldwide SR-71 mission during the Cold War. Vono’s Dad, Mike, was a WWII B-24 ball turret gunner in Europe and his Uncle Chuck was a Navy gunner engaged in every major combat operation in the Pacific. For more information on Vono, his other roles, his blogs about his stories (and his Dad and Uncle’s stories), his presentations and technical papers, and his upcoming book, visit charlesvono.com.

Abstract: “Fundamentals of Complex System Sustainment”

This presentation is for the serious and seasoned systems engineering manager or team member who is looking for an integrated approach to keeping large, complicated, and even complex systems fulfilling their missions for decades. Based on the same methods used for ICBMs, this presentation has helped audiences from other weapon systems and civilian systems think creatively about their system sustainment issues. Audiences receive a copy of The Sustainment Handbook by Charlie Vono.

Abstract: “In-Flight Refueling the SR-71 During the Cold War”

This presentation is for any audience looking for a few good stories featuring our high tech Cold War weapon systems. As a KC-135Q aircraft commander, Vono can relate firsthand what it meant to be a Cold Warrior, how the technology worked, and what he did when it didn’t work. These were the days when we used sextants to cross the Pacific, engines blew up routinely, and no mission went entirely as planned. With most of this highly classified mission now de-classified, Vono can spice up this Cold War stories with facts about the technologies and mission. A real crowd-pleaser, he always finds a few audience members who supported this mission and speak up with their own stories.

Abstract: “How Do Our Nation’s ICBMs Work?”

This presentation is often geared to a younger audience by providing the basics of how a ballistic projectile can be precisely delivered halfway around the world. There is plenty of open-source, unclassified, and non-sensitive information on Minuteman III and other ICBMs to keep an audience interested without spilling national secrets. Or this presentation can be targeted to those older citizens wondering if their tax money should be spent on a new ICBM. What is the mission? Why is it important? Why can’t we just keep using 1970’s rockets? Lastly, this presentation can be focused on the often untold story of ICBMs in our Space Race and, in turn, how the Space Race was helpful to their development.

RANDII R. WESSEN

Email: randii.r.wessen@jpl.nasa.gov

Biography:
Dr. Wessen has been an employee of the California Institute of Technology's Jet Propulsion Laboratory since 1984. He is currently the A-Team Lead Study Architect for JPL's Innovation Foundry. Previously, Dr. Wessen was the Telecommunications and Mission Systems Manager for the Mars Program, the Supervisor for the Science System Engineering Group, Manager of the Cassini Science Planning & Operations Element, the Galileo Deputy Sequence Team Chief, and the Voyager Science Sequence Coordinator for the Uranus and Neptune encounters.

He received his Bachelors of Science in both Physics & Astronomy from Stony Brook University, a Masters of Science in Astronautics from the University of Southern California and a Doctorate in Operations Research from the University of South Wales, United Kingdom.

Dr. Wessen has written numerous papers on Market-Based Systems as applied to space exploration allocation problems and co-authored both the *Neptune: The Planet, Rings and Satellites* and the *Planetary Ring Systems* books. Dr. Wessen was the recipient of NASA's Exceptional Service Medal for his contributions to the Voyager 2 Neptune Encounter and has eleven NASA Group Achievement Awards. He was awarded JPL's highest honor, the Award for Excellence, for his "outstanding initiative, dedication, and contagious enthusiasm" for his public outreach efforts. Dr. Wessen is also a fellow of both the Royal Astronomical Society and the British Interplanetary Society, and an AIAA Associate Fellow.

Abstract: The Future of U.S. Planetary Exploration
Planetary exploration is composed of a number of evolutionary missions punctuated by a few revolutionary ones. Initially, planetary missions were sent on trajectories passed worlds for brief periods of time to determine their fundamental characteristics. Planetary exploration has now progressed to orbiter missions that remain in orbit for years at a time, enabling them to study atmospheric dynamics, surface morphology, and magnetospheric science. Orbiter missions have been sent to Mercury, Venus, Earth, Mars, Asteroids, Jupiter, and Saturn. Those targets deemed sufficiently interesting will have probes sent into their atmospheres or samples returned from their surfaces.

This presentation will discuss the robotic planetary missions currently in operations at the Jet Propulsion Laboratory and those planned for the upcoming decades. It will include the search for "Terra Nova," the search for an Earth-like planet outside of our Solar System.

Abstract: Market-Based Systems for Solving Space Exploration Resource Allocation Problems
Of the many aspects of space exploration history can record, the development of the spacecraft and its science payload has been anything but historic. Cost and mass growths can and do exceed 200% of their initial estimates. An innovative approach for allocating these scarce spacecraft resources has been developed which is based on the market forces of supply and demand. Its first application was to manage requests for additional resources during the development of Cassini's science instruments. Cassini is a Saturn orbiter that delivered twelve state-of-the-art instruments and an atmospheric probe to Saturn in 2004.

This presentation will describe what experimental economics is, the two major types of systems, and results from the Cassini Resource Exchange, Space Shuttle manifest scheduling, and LightSAR mission

planning when a market-based system was employed.

Abstract: The Astronomical Search for Origins & Planetary Systems

Ever since we first looked up at the night sky, humans have been intrigued by two questions: Where did we come from? And are we alone?

Humankind is beginning to make progress in addressing these two timeless questions. This presentation will describe our current understanding of the:

- Formation of galaxies, stars and planets
- Search for planetary systems
- Definition of habitable worlds
- Planetary search techniques, and
- Future missions that will carry out this effort, and continue our pursuit to understand the implications of these questions

Addressing the issue of the possibility of life in the cosmos, Arthur C. Clarke said, “Sometimes I think we are alone in the Universe, and sometimes I think we’re not. Either answer is terrifying!” Come hear how humanity is taking up this quest.

ROBERT C. "BOB" WINN

Email: rcwinn@engsys.com

Biography:

Dr. Winn is a mechanical/aeronautical engineer, Principal and Chairman of the Board of Engineering Systems Inc. (ESI). ESI provides a wide range of technical support capabilities, including metallurgical, materials, aeronautical, mechanical, structural, electrical, safety, automotive, and audio/visual services. He has been with ESI since 1994 and during that time has reconstructed hundreds of aircraft accidents. Dr. Winn retired from the U.S. Air Force in 1991 after a 22-year career. He was an instructor pilot in four different Air Force aircraft, taught aeronautical engineering at the USAF Academy, and served as Chief Scientist of the USAF European Office of Aerospace Research and Development in London, England. He is a Fellow of AIAA and a Fellow of the Royal Aeronautical Society. He has served as a member of the SAE AC-9C Subcommittee on Aircraft Icing Technology. Dr. Winn has directed research; published over 70 technical papers, technical reports, and articles; and has given numerous presentations on a wide variety of technical and educational topics.

Abstract: "Animations versus Simulations"

Animations have become an important part of many litigations, particularly in the U.S. There are several good reasons to use an animation in the courtroom: (1) to convey a complex issue in an informative and entertaining way, (2) when time is an important issue in the issue, or (3) when the jury expects an animation (the other side has one). The big problem with (or perhaps advantage of) animations is that they do not have to obey the laws of physics; they are cartoons. As opposed to an animation, a simulation is an analytical solution of equations that are based in physics. A visual depiction of the results of a simulation may appear like an animation; conversely, there is no guarantee that an animation is the depiction of an activity that could actually happen. Some animations look so good that a jury will likely not be able to realize that the animation violates the laws of physics. In this presentation, the key features of a simulation are presented. In addition, examples of animations that violate the laws of physics and comparable simulations will be shown.

Abstract: "The Cold Truth about Aircraft Icing"

Aircraft in-flight icing has been an important factor in many aviation accidents, yet many pilots do not understand just what ice accretion can do to the performance of their airplane. This presentation briefly describes when and how ice can accrete on an airplane and discusses the changes in airplane performance that can result. In particular, some of the myths of aircraft icing will be dispelled. Examples of aircraft icing accidents that involved icing will be discussed.

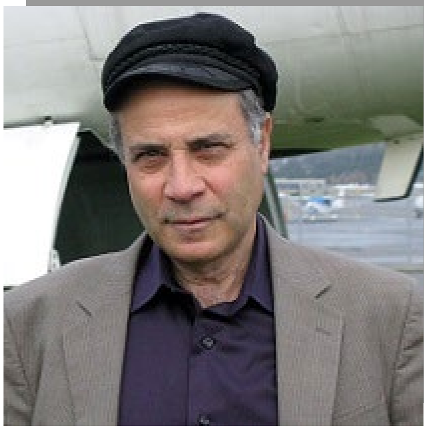
Abstract: "The Collapse of Big Blue"

In the summer of 1999, a 600-foot-tall crane collapsed during the construction of a new baseball stadium in Milwaukee. The analysis of this failure involved determining the aerodynamic drag on the million-pound roof section that was being put in place, soil elasticity analysis, a dynamic analysis of the entire crane system, and a metallurgical analysis of the components that failed. This accident was captured on video which is shown during the presentation. This analysis would be of interest to many disciplines, not just aviation.

Abstract: “Anatomy of an In-Flight Breakup”
A number of in-flight breakups occur every year. The fundamentals of in-flight breakups reveal that there are only three root causes: fatigue of a key structural element, flutter, and overload. Each of these causes will be discussed and explained. An example of an in-flight breakup in which the experts disagreed as to the root cause will be discussed in detail. The discussion will include analysis of the aircraft wreckage, fundamental airplane fluid dynamics, trajectory analyses, and airplane performance. The presentation is supported with videos, demonstrations, and high-definition animations.

Abstract: “New Tools in Aircraft Accident Reconstruction”
An engineering approach to accident reconstruction really began approximately 40 years ago with Bach and Wingrove, who developed a technique for estimating aircraft performance using recorded radar data for NASA. Recent improvements in their approach will be explained. Flight data recorders have been used in airline accident analysis, but with the increased use of electronics in general aviation airplanes, flight data recorder quality information is often available. Examples of each of the new technologies will be presented and discussed, including CT scanners, Lidar, laser scanning of accident scenes, 3-D printing, the use of UAVs and virtual reality, and others.

Abstract: “Accident Reconstruction Needs Data – Where to Get It and How to Use It”
Almost every aviation accident gets reconstructed after, sometimes well after, the accident. The accuracy and completeness of that reconstruction depends on the amount and the quality of the data used in the reconstruction. The first accidents were reconstructed using the wreckage and any eyewitnesses that happened to see what happened. Eventually radar data, when available, were used to describe the flight path the aircraft. In the mid-1970s, we learned how to extract airplane performance from the radar data. Flight data recorders added a lot of fidelity to the airplane performance analysis, but only airliners and a few business jets had flight data recorders installed. With the advent of electronic cockpit displays, a lot of data were used on even general aviation aircraft. Now, data are recorded on devices that didn’t even exist just a few years ago. This presentation will show where we can find relevant data and how we can use it.



ROBERT ZUBRIN

Email: cfay@marssociety.org

Biography:

Robert Zubrin, formerly a Staff Engineer at Lockheed Martin Astronautics in Denver, is now president of his own company, Pioneer Astronautics. He holds Masters degrees in Aeronautics and Astronautics and a doctorate in Nuclear Engineering from the University of Washington. He is the inventor of several unique concepts for space propulsion and exploration, the author of over 200 published technical and non-technical papers in the field, as well as the non-fiction books *The Case for Mars: The Plan to Settle the Red Planet and Why We Must* (Simon and Schuster 1996), *Entering Space* (Tarcher Putnam 1999), *Mars on Earth* (Tarcher Penguin 2003) and *Energy Victory* (Prometheus Books, 2007). He is also the author of the novels *The Holy Land* (Polaris Books, 2003) and *First Landing* (Ace 2001), and most recently, the science-humor immigrant guidebook, *How to Live on Mars* (Three Rivers Press, 2008). He is a Fellow of the British Interplanetary Society and former Chairman of the Executive Committee of the National Space Society. Most recently, he founded the Mars Society, an international organization dedicated to furthering the exploration and settlement of Mars by both public and private means. In that capacity, he personally led the construction and operation of a human Mars exploration training station on Devon Island, an uninhabited island in the Canadian Arctic 900 miles from the North Pole. Prior to his work in astronautics, Dr. Zubrin was employed in areas of thermonuclear fusion research, nuclear engineering, radiation protection, and as a high school science teacher.

Abstract: "Destination Mars: Human Mars Exploration & Colonization / Humans to the Red Planet Within a Decade"

In July 1989, on the 20th anniversary of the Apollo moon landing, the first President Bush called for America to renew its pioneering push into space with the establishment of a permanent lunar base and a series of human missions to Mars. While many have said that such an endeavor would be excessively costly and take many decades, a small team at Martin Marietta drew up a daring plan that could sharply cut costs and send a group of American astronauts to the Red Planet within ten years. The plan, known as "Mars Direct," has attracted international attention and broad controversy, including coverage in such publications as *Newsweek, Fortune, The Economist, Air and Space Smithsonian,* the *New York Times,* the *Wall Street Journal,* the *London Times,* the *Boston Globe,* and *Izvestia*. It has also been covered by the Discovery Channel, PBS, ABC, NBC, CBS, National Public Radio, and the BBC. Its principal author, Robert Zubrin, has presented it to such fora as the International Astronautical Federation congress in Germany, and the blue ribbon "Synthesis Group" headed by former Apollo astronaut General Thomas Stafford, the Augustine Committee, as well as to various government officials, including House Speaker Newt Gingrich, Senator John McCain, and NASA Administrators Dan Goldin, Mike Griffin, and Charles Bolden.

More relevant than ever: Can Americans reach the Red Planet in our time?