AIAA ALBUQUERQUE

JANUARY 2020

Shaping the Future of Aerospace

THE FLIGHT PLAN

The Newsletter of AIAA Albuquerque Section
The American Institute of Aeronautics and Astronautics

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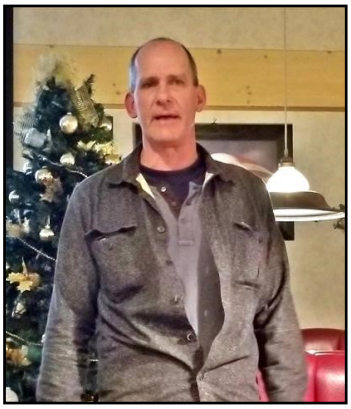
UPCOMING MEETINGS:

Jan 16: Basic Ballooning and the Balloon Fiesta – Neal Smith

Feb 20: High-pressure Supercritical Injection and some Fundamentals of Supercritical Fluids – Prof Daniel T. Banuti

DECEMBER 2019 SECTION MEETING: BACK-COUNTRY FLYING WITH A HOME-BUILT AIRPLANE.

Dennis Kirby
Air Force Nuclear Weapons Center



Dennis Kirby spoke to section members about his experiences of flying among the beautiful skies and landscapes of New Mexico. He often flies to many backcountry airstrips and enjoys camping there with friends who also fly their own small aircraft to these out-of-way sites.

CALENDAR

Local Section Events

Thursday 16 January — Section Meeting

Basic Ballooning and the Balloon Fiesta

Copper Canyon Café: 5455 Gibson Blvd, Albuquerque
5:30pm Meet and greet
5:45pm Dinner (order when ready)
6:30pm Presentation and discussion

Upcoming U.S. Launches

TBD LauncherOne • Inaugural Flight
Jan (Mid) Falcon 9 • Starlink 3
Jan (Late) Falcon 9 • Starlink 4
Feb 5/6 Atlas 5 • Solar Orbiter
Feb 9 Antares • NG-13
Feb (Mid) LauncherOne • ELaNa-20
Feb 15 Minotaur 4 •

National AIAA Events

2nd International Academy of Astronautics (IAA) Conference on Space Situational Awareness
14—16 January 2020
The IAA Conference on Space Situational Awareness will take place at the Hilton Arlington 950 N Stafford St., Arlington, VA, USA

66th Annual Reliability & Maintainability Symposium (RAMS®)
27—30 January 2020
The Annual Reliability and Maintainability Symposium (RAMS®) is a yearly gathering of the product assurance disciplines where training, tutorials, and the latest technical practices, procedures, and results are presented in easy-to-utilize forums and proceedings.

CALL FOR SCHOLARSHIP APPLICATIONS

By DR. Stephen Seiffert—AIAA Albuquerque Section Honors & Awards Chair

The Albuquerque AIAA Section has an established annual scholarship, this year's is for $1000, awarded in May of 2020. Undergraduates or graduate students enrolled in the University of NM, the NM Institute of Mining and Technology, NM Highlands University, and Northern NM College are eligible for application. The **application deadline is April 10.** A winner announcement will be posted on or about May 1 and presentation of the award is at the annual AIAA Awards Banquet held in mid-May in Albuquerque.

Undergraduate applicants must have completed at least 60 hours in a degree-granting curriculum by the end of the semester of application. Graduate students must be admitted to a degree program.

Students from all applicable schools should check for the announcement, application instructions and deadlines, and forms and instructions posted on the **UNM School of Engineering website the last week of January**: www.soe.unm.edu/scholarship/.

Points of contact regarding the scholarship include:

UNM: Dr. Svetlana Poroseva poroseva@unm.edu
Honors & Awards Chair: Dr. Stephen Seiffert seiffert@flash.net

AIAA Lecture (January 16th)

Basic Ballooning and the Balloon Fiesta.

Neal Smith, Sandia National Laboratories

Neal Smith will share his experience as a commercial pilot, rated for hot air balloons. He has been flying hot air balloons since the early '90's, and has accumulated over 400 flight-hours in hot air balloons. He has been a volunteer launch director and flight operations safety officer at the Albuquerque International Balloon Fiesta, and was chief of flight safety in 2015. Neal's presentation will cover topics such as:

- **How he got started in ballooning**
- **License requirements**
- **How hot air balloons & gas balloons work**
- **The history of ballooning and ballooning in Albuquerque**
- **The Fiesta**

Speaker Bio:

Neal is a systems engineer with an undergraduate in nuclear engineering from Oregon State University and a Master of Science in Computer Science with a specialization in software engineering and test. He spent 12 years active duty in the US Air Force with his first assignment here at Kirtland Air Force base performing satellite suitability and vulnerability analysis and engineering. In his next assignment at Wright-Patterson Air Force Base he performed similar studies for aircraft and managed the final development and deployment of the cockpit controls and displays avionics for first six operational stealth bombers. He continued collecting eclectic engineering experiences as a sustaining engineer for satellite ground control systems, a software test engineer for one of the previous century's most successful strategy-based computer games, a computer science instructor at two PAC 12 universities, a system safety engineer for the Airborne Laser program, and a center-level staff systems engineer. He is currently a research and development engineer on contract to the Department of Energy.

When:	January 16, 2020 (Thursday)	COST: Pay for your own meal
Where:	Copper Canyon Café, (505-266-6318)	5:30 - 5:45 Meet and Greet
	Albuquerque NM 87108	5:45 - 6:30 Dinner (order when ready)
	(at Gibson and San-Pedro)	6:30 ~ 7:30 Presentation & Discussion

Students: Don't forget that we offer free dinners (up to $15) for up to six students!

Click Here to RSVP

https://docs.google.com/forms/d/1T8z2aAe_WIRsqoNVZl2iKleXjwtDPPE07VXuIuNhhCM/viewform

SECTION MEMBERS IN THE NEWS

By UNM Dept. of Mechanical Engineering News

State of shock: 200-year-old law about gas mixtures called into question

December 6, 2019 - by Kim Delker

According to a new study led by a team from The University of New Mexico, centuries-old laws about the behavior of gas mixtures do not

This finding could have potential impact for everything that involves mixtures of gases exposed to a shock wave, for example, during combustion in an engine. This is also relevant for conventional and nuclear explosions, supersonic jets, gas-cooled nuclear reactor plants, and inertially-confined fusion.

The results were published this week in the paper "Dalton's and Amagat's Laws Fail in Gas Mixtures with Shock Propagation" in *Science Advances*. Authors on the paper are Patrick Wayne, Daniel Freelong, Gregory Vigil, Timothy Clark, Peter Vorobieff and C. Randall Truman from the Department of Mechanical Engineering at UNM; Sean Cooper, J. Mike Walker '66 Department of Mechanical Engineering, Texas A&M University; Dylan Simons, Department of Aeronautics and Astronautics, Air Force Institute of Technology; Ignacio Trueba-Monje, Aerospace Engineering Department, The Ohio State University; and Vladimir Vorob'ev, Joint Institute for High Temperatures, Russian Academy of Science.

Above: Patrick Wayne, who received a Ph.D. from the UNM Department of Mechanical Engineering, was lead author on this study.

The study, conducted at UNM, involved pre-mixing two gases with dramatically different properties: light helium and heavy and viscous sulfur hexafluoride. The team characterized the properties of the resulting mixture, which agreed well with classical theory, then a shock wave was introduced, and the temperature and pressure of the shock-accelerated medium were measured over several milliseconds – a short time to think of in normal terms, but a long interval compared with the time scales associated with the shock wave passage. The researchers found that the temperature and pressure after the shock compression did not line up with what would have been expected from the predictions of either of the two classical theoretical laws – Dalton's or Amagat's.

French physicist Emile Hilaire Amagat's law of partial volumes from 1880 states that the total volume of a gas mixture is equal to the sum of the partial volumes each gas would occupy if it existed alone at the temperature and pressure of the mixture. And in 1802, scientist John Dalton stated that the total pressure in a non-reactive gas mixture – at constant temperature and volume – is equal to the sum of the partial pressures of the component gases.

"Our study found that classical laws used to predict gas mixture properties fail to work in a fairly common and practically important situation," Vorobieff said.

The reason for disagreements is that neither classical law can accurately describe what happens on the molecular level, he said. Simple considerations of time scales from kinetic molecular theory, and how they are affected by shock acceleration, appear to provide at least a qualitative explanation of the experimental observations. Vorobieff said that although this is a solid first step, the ultimate implications have not yet been determined, and much further study is required. Possible impacts could mean a design change in mechanisms like engines that take into account how shock waves affect the gas mixture properties.

"Our work has shown that classical gas mixture theory does not work in shock-accelerated and possibly other compressible flows," Vorobieff said. "We must conduct experiments with more gas mixtures and a broader range of conditions to explore the scope of the problem and develop a theory explaining our observations."

Patrick Wayne was our section's scholarship winner in 2013.

DISCOVER STEM DAY

By Elfego Pinon III—STEM K—12 Officer

On Saturday, February 8, 2020, the AIAA Albuquerque Section will once again be participating in the Discover STEM Day at the National Museum of Nuclear Science and History in Albuquerque. That day, the museum will welcome families and Scouts, as well as the general public, to learn about various STEM careers.

The Discover STEM Day is the last day in a week-long series of events hosted by the museum. Each day students from the underserved 4th-8th grade classes across Albuquerque and beyond visit the museum to spark their interest in the fields of science, technology, engineering, and mathematics through hands-on activities and interaction with the region's leading science and engineering professionals.

In each of the past few years, the museum has served over 1000 students—including students that don't typically have the opportunity to see and experience these activities.

The AIAA Albuquerque Section has been a regular participant in the event, and it has been very busy the past few years—so the more volunteers, the better! Anyone who is interested in volunteering is welcome to help out for as long as you want. Even showing up for one hour helps as it gives some of the full-time volunteers time to take a quick break. All volunteers who sign up before the event get free admission to the museum that day and those that are at the museum around lunch time (typically from 11:30 a.m. until 1:00 p.m.) get free lunch provided by some of the other sponsors (e.g., Dion's has provided pizza and salad in the past).

Our booth is always popular because we bring out our Dreamflyer flight simulator that lets students experience what it's like to fly an aircraft. We typically have other displays including various guided missile parts, a laptop-based flight simulator, and various aerospace-related videos running. We also have giveaway items to hand out to visitors to our booth and can use help with any of these activities.

The event runs from 10:00am to 3:00pm on Saturday, February 8. If you're interested in helping out, please contact Elfego Pinon III at:

elfego.pinon@emergentspace.com .

From previous years

Flying the Dream-Flyer

The desk-top flight simulator

Aerospace videos

Missile Guidance systems

Future pilots

SUPER STEM SATURDAY

By Robert Malseed—Treasurer

Once again, our Section is looking for volunteers (onsite training provided so no experience needed) to support our displays and demos at the **New Mexico Super STEM Saturday**, on 22 February at the Albuquerque Convention Center. This will be the 3rd Year that the Albuquerque Section has brought out our flight simulators, displays, and AIAA handouts to the event. The event goes from mid-morning through mid-afternoon, but you can volunteer for any portion of the day.

For those not familiar with Super STEM Saturday, this is an amazing event hosted by the Air Force Research Lab, supported by a number of local laboratories, companies, non-profits and educational organizations; and is designed to inspire the next generation of outstanding scientists and engineers. Last year, the event launched trashcans 50 feet into the air, had dueling Tesla coils with ft. long arcs of lightning, robots of all kind, a cannon that accelerates ping pong balls to supersonic speed, tons of fun with liquid nitrogen, and many more jaw-dropping STEM demonstrations. Ultimately, Super STEM Saturday had over 100 organizations, and more than 3,000 visitors.

Please volunteer to help us!

For more information, or to volunteer, contact:

Elfego pinon at:

elfego.pinon@emergentspace.com

Or Ben Urioste at:

BenUrioste@gmail.com

Last Year

Flight technology

Missile technology

Flying the DreamFlyer

The desktop flight simulator

We had visitors from a galaxy far, far away.

VISITING THE HILL AEROSPACE MUSEUM

By Mark Fraser—Public Policy Officer

During a business trip a few months ago I had the opportunity to visit the Hill Aerospace Museum, next to Hill Air Force Base, north of Salt Lake City. It exhibits more than 80 USAF, USAAF, USN and former Warsaw Pact fixed-wing aircraft, helicopters, and

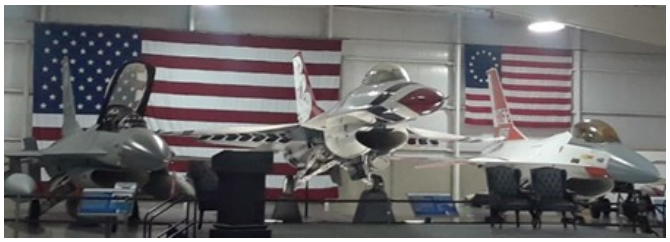
(Continued on page 10)

Mark with the C-47 (a modified DC-3)

A JetStar, like the one my dad flew.

P-51 Mustang

The beautiful SR-71 Blackbird



F-16s

Various aircraft (HH-43 foreground)

F-100, 102, 104, 106

F-89 Scorpion

SCIENCE FAIR — JUDGES NEEDED

By Robert Malseed—Treasurer

This year's Central New Mexico Science and Engineering Research Challenge (Science Fair) will be judged on Friday 27 March at the Manuel Lujan Exhibit Complex in Expo NM. (State Fair Grounds) Our section will choose four individual projects (usually 2 junior and 2 senior) for our annual awards. The winners will each receive a certificate and $100 check, a 1-year student membership in AIAA, and an invitation to our May awards meeting where they, along with one guest and teacher, will be our guests for dinner.

If you can help with the judging, please contact our Treasurer, Robert Malseed, (Robert@malseed.com) for details. He won't be in town for judging this year, so we need YOU.

This is a rewarding experience. Here are some scenes from the past. Interviewing our winners in 2013.

Svetlana, Lori, Stev, and Robert listen to Mario Morford-Oberst (8th grade) explain his propeller project.

Ethan Santangelo (12th grade) & his nanosatellite project.

Robert, Stev, and Mike talk with Josh Ludwigsen (10th grade) about pressurized glove joints.

Gianina Revels (7th grade)& her glider project.

THIS MONTH IN AIR & SPACE HISTORY

235 Years Ago - 1785

January 7: First international air mail letter carried by Jean-Pierre Blanchard of France and John Jeffries of the U.S. across the English Channel by balloon from Dover to Calais.

100 Years Ago – 1920

January 2: Science fiction writer Isaac Asimov is born.

90 Years Ago – 1930

January 20: US astronaut and Apollo 11 crewmember Edwin Eugene “Buzz” Aldrin, Jr., is born.

60 Years Ago - 1960

January 14: President Eisenhower directed the transfer of the Army Ballistic Missile Agency's (ABMA) Development Operations Division (headed by Dr. Wernher von Braun) to NASA.

January 21: Little Joe 1B launched at 7:00 p.m. EST from Wallops Island, VA. This was a test of launching and abort systems of the Mercury spacecraft. A Rhesus monkey "Miss Sam" was on board.

55 Years Ago - 1965

January 19: Gemini Titan 2 launched by Titan 2, an unmanned test of the launch vehicle and the Gemini spacecraft, 9:04 a.m., EST, Cape Canaveral, Fla.

January 22: Tiros 9 orbited, approximately 2:50 a.m., EST, Cape Canaveral, Fla.

50 Years Ago - 1970

January 14: Intelsat III F-6 launched by Delta , 7:16 p.m., EST, Cape Canaveral, Fla.

January 23: ITOS 1/Oscar 5 launched by Delta at 6:34 a.m., EST, Vandenberg AFB.

45 Years Ago - 1975

January 22: Landsat 2 launched by Delta, 12:56 p.m., Vandenberg AFB.

40 Years Ago – 1980

January 17: Fleetsatcom 3 launched by Atlas- Centaur, 8:26 p.m., EST, Cape Canaveral, Fla.

35 Years Ago - 1985

January 7: Sakigake launch (Japan Comet Halley Mission) Launch Vehicle: M-3SII. Launch Site: Uchinoura Space Center, Japan.

January 24: STS-51C (Space Shuttle Discovery) launched from KSC, 2:50 p.m., EST. Payload was a Department of Defense spacecraft using the Inertial Upper Stage (IUS) booster. Crew: Thomas K. Mattingly, Loren J. Shriver, Ellison S. Onizuka, James F. Buchli and Gary E. Payton. Landed January 27 at KSC, 4:23 pm.,EST. Mission Duration: 3 days, 1 hour, and 33 minutes.

30 Years Ago - 1990

January 9: STS-32 (Space Shuttle Columbia) launched from KSC at 7:35 a.m., EST, and shortly after achieving orbit deployed Syncom IV-5. Columbia retrieved Long Duration Exposure Facility (LDEF) on January 11. Crew: Daniel C. Brandenstein, James D. Wetherbee, Bonnie J.Dunbar, Marsha S. Ivins, and G. David Low. Landed January 20 at Edwards Air Force Base (EAFB), CA at 1:35 a.m., PST. Mission Duration: 10 days, 21 hours.

January 24: Hiten, (formerly Muses-A) launched by M3S2 launch vehicle from Uchinoura-Cho, Kagoshima, Japan. Hiten was Japan's first-ever lunar flyby, lunar orbiter and lunar surface impact. Japan was the third nation to orbit the Moon.

THIS MONTH IN AIR & SPACE HISTORY

20 Years Ago – 2000
January 3: Galileo probe flyby of planet Jupiter's moon, Europa.

15 Years Ago – 2005
January: A long-duration scientific balloon carrying the Cosmic Ray Energetics and Mass (CREAM) experiment set flight records for duration and distance, flying for nearly 42 days and making three orbits around the South Pole.

January 12: Deep Impact launched by a Delta 2 rocket from Cape Canaveral at 1:47 p.m. EST. It flew by Comet Tempel 1 on July 4, 2005 and ejected an impactor into the comet.

10 Years Ago – 2010
January 22: NASA astronaut T.J. Creamer on the ISS sent the first live, unassisted tweet from space.

5 Years Ago – 2015
January 31: Soil Moisture Active Passive (SMPA), is an Earth satellite mission that measures and maps Earth's soil moisture and freeze/thaw state to better understand terrestrial water, carbon and energy cycles. Launched from Vandenberg Air Force Base on a Delta II 7320 at 14:22:00 UTC.

(Continued from page 7)

VISITING THE HILL AEROSPACE MUSEUM

missiles.

The museum is quite impressive. Check out their official website, video, and featured aircraft.

Various aircraft

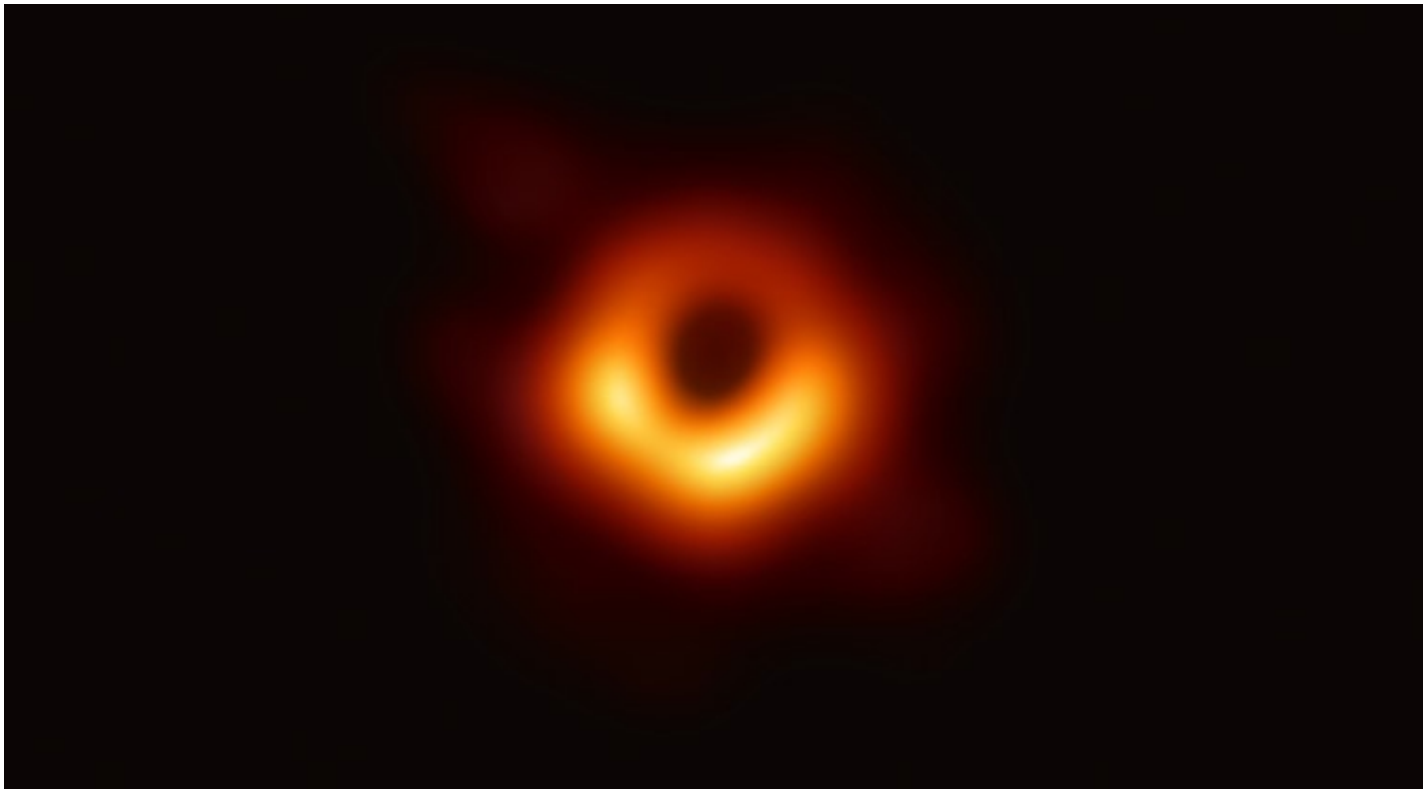
B-1

B-52 and KC-135

In the gift shop, promoting women in STEM

IMAGE OF THE MONTH

Black Hole Portrait



On April 10, Event Horizon Telescope researchers revealed the first direct visual evidence of the supermassive black hole in the center of Messier 87 and its shadow. (Image: EHT Collaboration)

With the help of two radio telescopes coordinated by the University of Arizona, astronomers took the first direct image of a black hole. By connecting radio telescopes across five continents into one Earth-sized virtual telescope, they managed to resolve the shadow of a supermassive black hole, a prediction of Einstein's General Theory of Relativity. Twenty-one students expanded their educations by participating in efforts to see the unseen with the Event Horizon Telescope. Science News named it the No. 1 science story of 2019.

PARTING THOUGHTS

"Everything was so new - the whole idea of going into space was new and daring. There were no textbooks, so we had to write them."

— Katherine Johnson

SECTION INFORMATION

AIAA ALBUQUERQUE

Chair	Mr. Ben Urioste
Vice-Chair	
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Treasurer	Mr. Robert Malseed
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Honors & Awards	Dr. Stephen Seiffert
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STEM K-12	Dr. Elfego Pinon III
UNM Student Advisor	Dr. Svetlana Poroseva

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Join or renew your membership
online at www.aiaa.org.

AIAA MISSION AND VISION STATEMENT

AIAA's mission is to inspire and advance the future of aerospace for the benefit of humanity. AIAA's vision is to be the voice of the aerospace profession through innovation, technical excellence, and global leadership.